United States
Department of
Agriculture

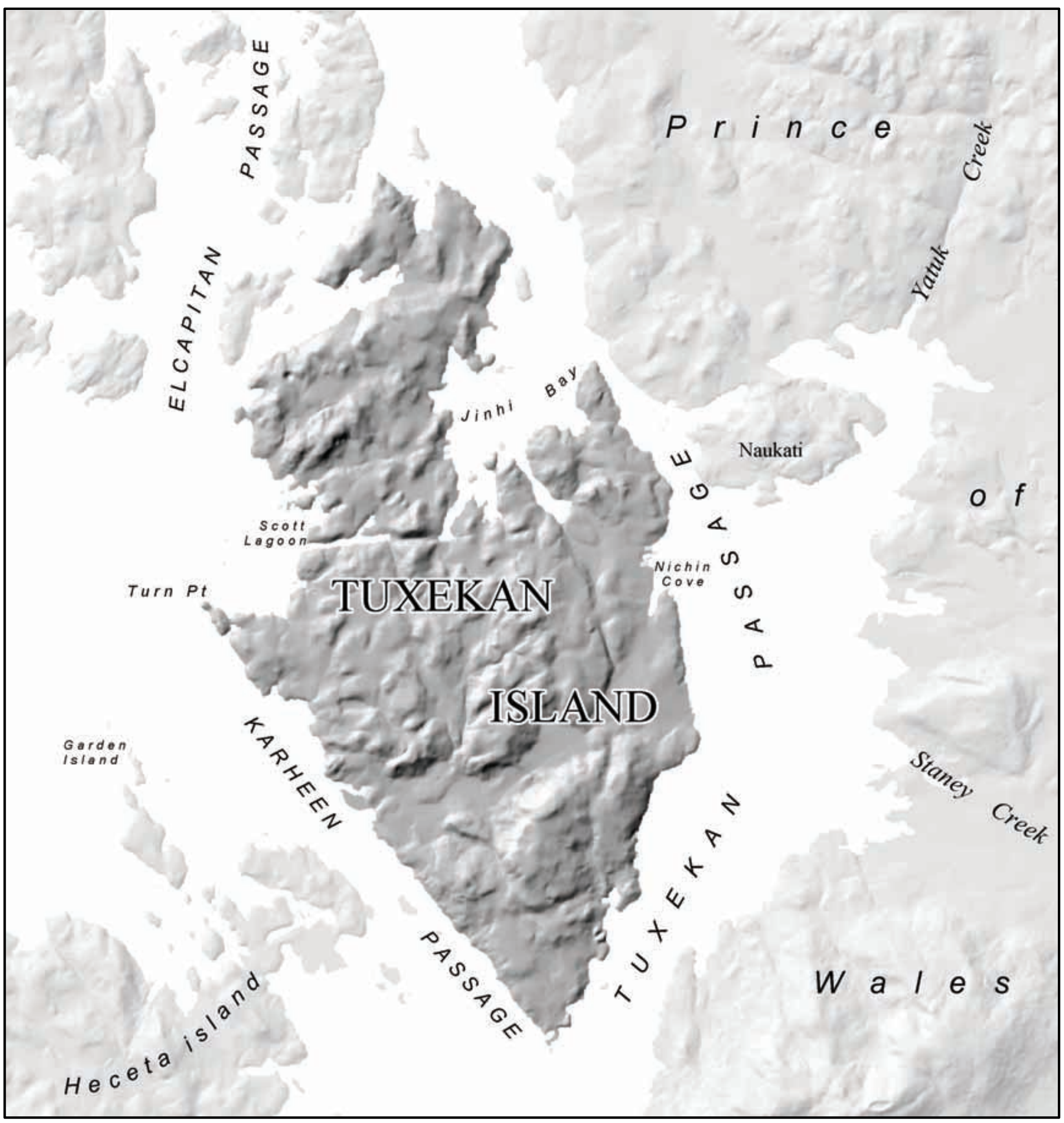
Forest Service

Tongass National
Forest

R10-MB-533B

October, 2006

Tuxekan Island Timber Sale Volume B - Final Environmental Impact Statement



United States Department of Agriculture | Forest Service | Alaska Region
Tongass National Forest | 648 Mission Street
Ketchikan, AK 99901
Phone: (907) 225-3101
Fax: (907) 228-6215

File Code: 1950-3
Date: October 3, 2006

Dear Planning Participant:

Enclosed is your copy of the Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) for the Tuxekan Island Timber Sale Project on the Thorne Bay Ranger District, Tongass National Forest.

The FEIS describes one no-action alternative and four action alternatives for timber harvest in the Tuxekan Project Area. Alternative 5 was developed in response to your comments on the Draft EIS. Responses to your comments can be found in the FEIS. The ROD explains my decision to select Alternative 5, and the factors considered in reaching my decision.

Information concerning implementation of this decision and appeal rights are included in the ROD. New regulations (36 CFR 215) regarding appeals of NEPA decisions became effective June 4, 2003 and contain new requirements related to appeal eligibility and appeal filing requirements.

Copies of the FEIS and ROD have been mailed to those who requested to remain on the mailing list for this project. Additional copies are available at the Thorne Bay Ranger District, P.O. Box 19001, Thorne Bay, Alaska, 99919, or by calling 907-828-3304.

I want to thank everyone who took time to review and submit comments on the Draft EIS and those who participated in the Subsistence Hearings. Your comments and involvement throughout this project have been important to me, and I appreciate your continued interest in the management of the Tongass National Forest.

Sincerely,

FORREST COLE
Forest Supervisor

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Tuxekan Island Timber Sale FEIS and ROD

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Chapter 1 – Purpose and Need

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Chapter 1 – Purpose and Need

Introduction

Chapter 1 displays the proposed action, purpose and need, public involvement, and issue development for the Tuxekan project.

Project Summary

The Notice of Intent (NOI) and subsequent public involvement for the Tuxekan Island Timber Sale Project (referred to as the Tuxekan Project) proposed timber harvesting on approximately 2,100 acres that would produce an estimated harvest volume of 20 million board feet (mmbf).[1]

Following publication of the Draft Environmental Impact Statement (DEIS; December, 2004) for the Tuxekan Project, further fieldwork and analysis were completed. As a result, the proposed action (Alternative 3) was modified and renamed the Modified Proposed Action (Alternative 3) for the FEIS. For a discussion of the history of the Tuxekan Project see the Background section below.

Alternative 3 (Modified Proposed Action) proposes timber harvesting on a unit pool of approximately 1,276 acres (34 units; 570 acres of harvesting; 706 acres deferred) that would produce an estimated harvest volume of approximately 20.2 mmbf. Small old-growth reserves as defined in the Tongass National Forest Land Management Plan (Forest Plan) (USDA FS 1997) with some minor adjustments, would be implemented. To implement the project approximately 9.6 miles of road construction (4.7 miles National Forest System (NFS)[2]; 4.9 temporary) and approximately 2.0 miles of road reconstruction would be needed (see the section 2001 Roads Rule on page 1-6). For a detailed list of proposed activities, see Table 1-1 below.

In preparation of this Final Environmental Impact Statement (FEIS), the numbers for the FEIS were rerun using current data and the suitability process as outlined in the suitability runs for the SEIS (2003). Therefore, there may be some minor changes from the DEIS.

Site-specific needs for the Tuxekan Project Area and potential resource effects have been considered in the preparation of this Tuxekan Island Timber Sale Final Environmental Impact Statement (FEIS). The alternatives are proposed to implement management direction as outlined in the Forest Plan and applicable state and federal laws.

If an action alternative is implemented, actual amounts of activities accomplished on the ground (measured in acres, miles, or board feet) may differ slightly from current estimates. Any variance would be in accordance with Forest Plan Standards and Guidelines and any applicable laws and regulations and would be documented in the Tuxekan project file.

There are instances where roads, in order to access harvest areas, traverse across areas deferred or reserved from harvest for goshawk and marten standards and guidelines. These are existing or proposed new roads or temporary roads. The interdisciplinary team (IDT)

[1] Information from: Tuxekan NOI, Federal Register, 3/20/2000 and Tuxekan scoping letter date, 4/1/2000
[2] The term National Forest System road has replaced the term “classified” road per the OHV Rule published on Nov. 9, effective Dec. 9: (36 CFR parts 212, 251, 261, and 295) direction.

recognizes that, where roads traverse forested deferral or reserve areas, the canopy within the road clearing is no longer suitable habitat, and those acres must be accounted for in the application of Forest Plan Standards and Guidelines for canopy retention. These are very small acreages (fractions of acres) and they are difficult to track during the planning stages. During field layout of roads, cutting units, and windfirm buffers, crews would include road clearing acreages along with harvest unit acreages (in clearcut with reserve (CCR) units) in calculating the acreage needed for deferral. These situations are noted on unit cards.

Project Area

The 17,730-acre Tuxekan project area encompasses all of Tuxekan Island in townships 69 and 70 east (T69E, T70E) and ranges 78 and 79 south, (R78S, R79S), Copper River Meridian, on the Thorne Bay Ranger District of the Tongass National Forest (Tongass). Tuxekan Island is located west of Prince of Wales Island, about 29 air miles northwest of Thorne Bay, Alaska. (Figure 1-1).[3] The project area is bounded on the northeast by Tuxekan Narrows, on the southeast by Tuxekan Passage, on the southwest by Karheen Passage, and on the northwest by Sea Otter Sound. National Forest System (NFS) lands comprise 95 percent of Tuxekan Island (16,894 acres). Two parcels of state land near Jinhi Bay (836 acres) are located within the project area. Access to the area is by boat from Prince of Wales Island or by floatplane.

The Forest Plan mapped three small unroaded areas of less than 1,000 acres in the project area. These areas do not meet the minimum criteria for Wilderness consideration. Tuxekan Island has no Inventoried Roadless Areas (IRAs). The project area includes value comparison units (VCUs) 556, 557, 560, and 587.2. The VCUs are comparable to large watersheds and generally follow major topographic divides (see *Chapter 4 Glossary* for a more detailed definition).

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[3] Note regarding GIS data: The Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. They may be: developed from sources of different accuracy, accurate only at certain scales, based on modeling or interpretation, incomplete while being created or revised, etc. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The Forest Service reserves the right to add, correct, update, modify, or replace GIS products without notification. For additional information contact: Tom Elliott USDA Forest Service, Digital Visions Enterprise Team, Building 24, Fort Missoula, Missoula, MT 59804

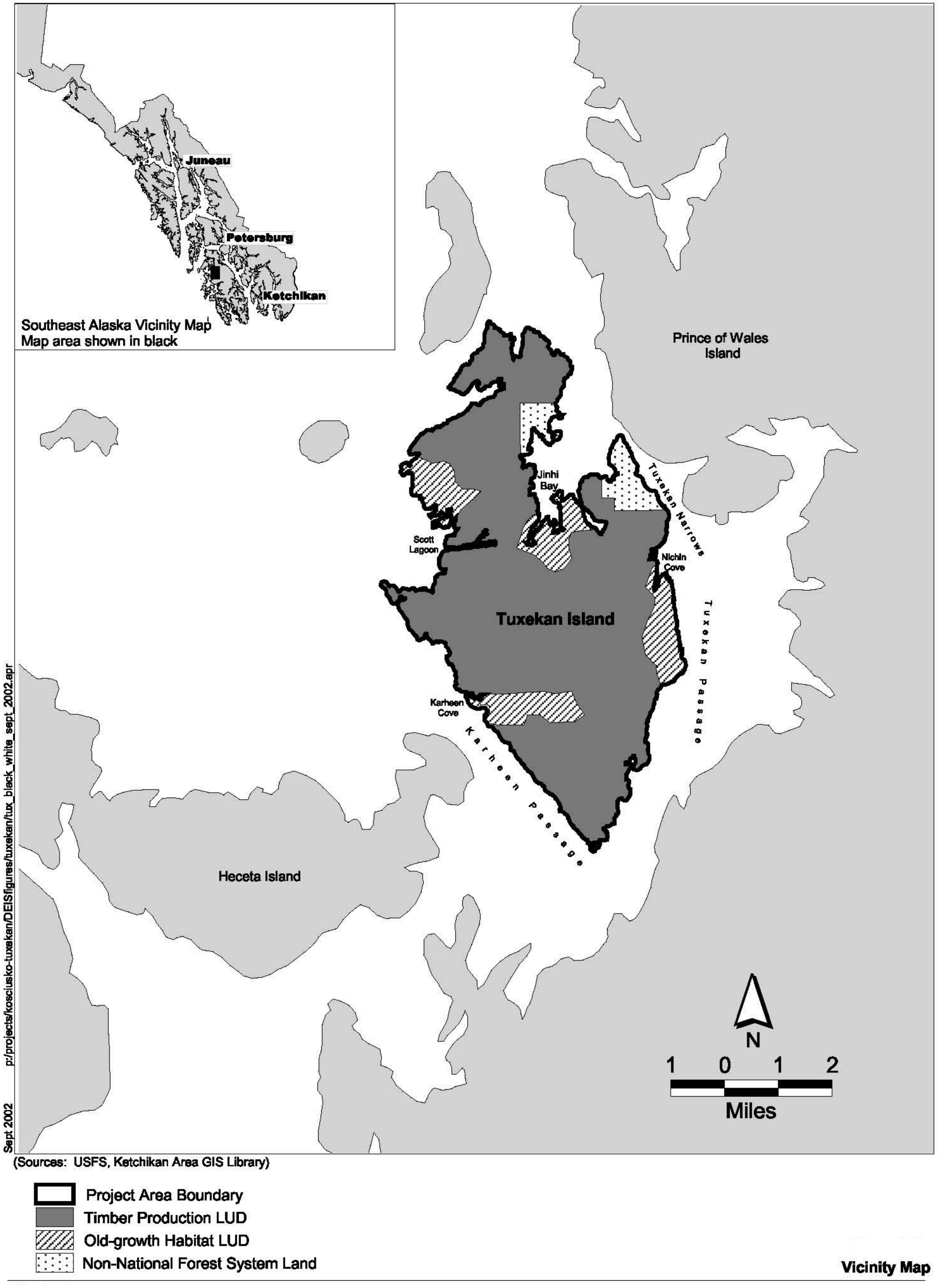

Figure 1-1. Vicinity & Project Area Maps

Analysis Areas

Some of the analyses done for this project use the project area as the analysis area. For certain resources, the analysis area may be a watershed, the whole island, or some other identified area. See individual resource sections for definitions of the specific analysis area used.

Modified Proposed Action

Table 1-1 summarizes the activities and outputs for the Tuxekan Project Modified Proposed Action (Alternative 3).

Table 1-1. Summary of activities in the Tuxekan project modified proposed action

Management Activity			Amount
Timber Management (Acres)[a]	Two-aged Management – Clearcuts with Reserves (CCR)		491
	Uneven-aged Management – Single Tree Selection (STS)		79
	Deferred or Reserved from Harvest		706
	Total unit acreage including acres deferred or reserved		**1,276**
	Average sustainable future harvest per year[b]		70
Modified Forest Plan Small old-growth Reserve (Small OGR) Adjustments	**Total Area in Small OGRs**		**3,935**
Road Work (miles)	Construction	National Forest System (NFS) road	4.7[c]
		Temporary road	4.9
		Total construction	**9.6**
	Reconstruction		2.0
Activity Results			
Potential Outputs (mmbf)	Harvest volume[d]		20.2[e]
	Small sale volume potential		2.7
Employment (Job years)[f]	Direct (WRC and AYC[g] domestic processing)		100
	Direct (WRC and AYC export)		92

[a] 34 units; average harvest within units is 14 acres per unit. Average size of planning (LSTA) units, units that are managed with this proposal, is 37 acres, which includes deferral areas.
[b] Suitable and available Productive Old Growth
[c] Includes 0.2 miles of unauthorized (previously unclassified) road that is being added to the NFS
[d] Includes estimated right-of-way volume
[e] mmbf – million board feet
[f] Employment estimates the number of job years created based on the Forest Plan estimate that 5.28 direct jobs are created per mmbf.
[g] Western red-cedar (which could include incidental amounts of Alaska yellow cedar)

Project Background

The Forest Service contracted with URS, a private contracting firm, from 2000-2002 to develop and analyze the Tuxekan Project. Scoping for the Tuxekan project was conducted in May of 2000.

Field studies were conducted in 1999 and 2000 to verify and update resource information contained in the Tongass geographic information system (GIS) and to collect specific information related to the issues of the timber sale. GIS resource information includes streams, important wildlife habitat, timber and soil inventories, and locations of proposed harvest units. Specific studies conducted for this FEIS include goshawk and other raptor surveys, swan surveys, stream, heritage, timber stand examinations (inventory) and karst surveys.

Vegetative cover in the project area inhibits aerial identification of karst features and accurate identification of areas with steep slopes. Because of the potential sensitivity of karst features to timber harvest and road construction, a laser-based technique called light detection and ranging (LIDAR) was used to obtain significantly better topographic information for the project area than was available using conventional photogrammetric methods. The topographic data supplemented field inventory techniques for location of karst features and was used to determine the presence and location of steep slopes in proposed harvest units. Groundwater flow paths in karst areas were traced using inert dyes.

Unit and road cards were used to document the locations and resource concerns for possible harvest units and roads (Appendices B and C). Resource specialists listed specific concerns on the cards and made recommendations to address or mitigate those concerns. Information from field studies and GIS was used to assess the issues, develop alternatives, and analyze the environmental effects of each alternative. General Forest Plan information found originally in the DEIS can now be found in Appendix G of this FEIS.

Inventories, resource specialist reports, and GIS information are part of the project planning record. The public scoping report and the unit and road design cards are also included in the planning record. The complete planning record, important supporting documents, and maps from the planning record will be maintained at the Thorne Bay Ranger District Office in Thorne Bay, Alaska.

The Forest Plan (Chapter 2) discusses the Forest-wide multiple-use goals and objectives for the Tongass. The concept of multiple-use is applied at the Forest level. Not every acre or every management prescription would achieve all goals for all resources. The goals are reached at the Forest level by providing a mosaic of land and resource conditions based on the 19 Land Use Designations (LUDs) described in Chapter 3 of the Forest Plan. Chapter 4 of the Forest Plan contains the Standards and Guidelines for the protection and management of all resources.

In June of 2005 Forest Service personnel conducted additional field surveys of karst features (Baichtal, 2005, pers. com.) and proposed road relocations (Emley, 2005, pers. comm.). As a result, a number of the proposed road locations were changed to avoid areas of high vulnerability karst (Table 1-2). See Table 1-3, Appendix B (Unit Cards), and Appendix C (Road Cards) to view the updated NFS and temporary road locations. While the road relocations decreased the amount of proposed road construction on high vulnerability karst, the road relocations increased NFS road between 0.7 – 1.0 miles (depending on alternative) and decreased the amount of temporary road of 0.6 – 1.0 miles. The Tuxekan Access Management plan was updated to be consistent with the draft Prince of Wales Access and Travel Management plan. Due to the update, an addition 1.7 miles of road will be put into storage (ML 1), and the open road density after project implementation will be reduced to 0.8 miles of road per square mile (Table 3-70).

Table 1-2. NFS Road Location Modifications Between DEIS and FEIS

Road Number	Included in Alternative	Miles of Road		
		DEIS Location	FEIS Location	Total Change in Individual Road Miles
1460015	**2, 3, 4, 5**	0.2	0.2	**0.0**
1460900	**2, 3, 4, 5**	0.2	0.2	**0.0**
1470000	**2, 3, 4, 5**	1.1	1.8	**+0.7**
1470131	**2, 3, 4, 5**	0.2	0.2	**0.0**
1470320	**3, 4, 5**	0.6	0.9	**+ 0.3**
1470330	**3, 5**	0.4	0.4	**0.0**

Table 1-3. Proposed NFS Road Location Modifications and Total Proposed NFS Road by Alternative

	Alternative			
	Alt 2	Alt 3	Alt 4	Alt5
Total NFS Road miles proposed by Alt. (FEIS)	3.1	4.7	3.9	4.3
Total change in proposed new NFS road miles between the DEIS and FEIS	+0.7	+1.0	+1.0	+1.0
Total Temp road miles proposed by Alt. (FEIS)	3.1	4.9	2.1	4.5
Total change in proposed new Temp road miles between the DEIS and FEIS	-0.6	-1.0	-0.7	NA

In April 2005 there were two sightings of a single goshawk in the vicinity of the Marine Access Facility (MAF; R. Slayton, Wildlife Technician, pers. comm.). Follow-up surveys were completed between June and August 2005 (Wildlife Report, project file).

Changes have been made between the DEIS and FEIS reflecting additional analysis in consideration of public comments and additional fieldwork. The numbers for the FEIS were rerun using current data and the suitability process as outlined in the suitability runs for the SEIS (2003). Alternative 5 was developed to address concerns raised by public comment. Please see the description and analysis of Alternative 5 in Chapters 2 and 3 of this FEIS.

2001 Roads Rule

As a result of the 2001 Roads Rule, the definitions of road reconstruction and maintenance have changed. The original road work proposals and analysis for Tuxekan were completed about the same time (2001) as the Roads Rule. Since that time, the national forests have received clearer guidance and are implementing these changes. Specifically, the roadwork package that was proposed under the DEIS included approximately 31 miles of road reconstruction. As a result of interpretation of the Roads Rule, approximately 29 miles are now considered as road maintenance. Some of these 29 miles of road maintenance have been implemented on the ground and would be considered as part of the existing condition for the project area.

Maintenance and reconditioning of existing National Forest System (NFS) roads is an ongoing process that occurs on a periodic basis. The maintenance and reconditioning of NFS roads on the project area may be in the process of implementation, before, during and after the NEPA process, through separate service contracts to reduce the backlog of deferred maintenance, recondition roads to comply with best management practices, maintain the existing infrastructure for the proposed timber sale, future harvest entries, and other National Forest management activities. Initially the Proposed Action listed approximately 31 miles of "road reconstruction". When this project was initiated, the work proposed as "reconstruction" was primarily to return existing NFS roads (within the existing road prism) to the level for which they were intended. On 01/04/2001 updates to the Forest Service Manual (FSM 7705; based on the Roads Rule) redefined Road Reconstruction as: Activity that results in improvement or realignment of an existing classified road as defined below:

a. Road Improvement. Activity that results in an increase of an existing road's traffic service level, expands its capacity, or changes its original design function.
b. Road Realignment. Activity that results in a new location of an existing road or portions of an existing road and treatment of the old roadway (36 CFR 212.1).

Road Maintenance has been redefined as: "The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective (FSM 7712.3)."

Based on the current definitions, only approximately 2.0 miles of the initial 31 miles of road identified are in need of reconstruction. The remaining approximately 29 miles would require maintenance, which does not require a site-specific NEPA decision. A portion of the project area roads have undergone maintenance since the DEIS was completed. The road maintenance on Tuxekan Island that was scheduled in 2004 and performed in 2004/2005 was done to: 1) maintain environmental compliance, and 2) ensure continued administrative access. The remaining road maintenance would be conducted before project implementation occurs. (See *04 aap tongass all districts.doc* [project file], which includes road maintenance on Tuxekan Island). This maintenance would improve road conditions within the project area. The Road Cards have also been updated to reflect these changes.

In this FEIS, there are approximately 2 miles of road reconstruction under Alternatives 3 and 5. Refer to Alternatives 3 and 5 in Chapter 2 and Appendix F for additional information.

Forest Plan Direction Summary

The LUDs developed in the Forest Plan guide management of the National Forest System lands (NFS) within the Tongass. Each designation provides for a unique combination of activities, practices and uses. Forest Plan Standards and Guidelines are designed to integrate activities to meet land allocation objectives. Many of the same standards and guidelines apply to different LUDs. Some are specific to certain LUDs or to individual areas of the Forest. This project adheres to all applicable Forest Plan Standards and Guidelines. NFS lands in the Tuxekan Project area are in two LUDs, Timber Production and Old-growth Habitat Guidelines. For a full description of the Timber Production LUD, see Forest Plan, pp.3-144 through 3-150 and for the Old-growth Habitat LUD, see Forest Plan, pp. 3-76 through 3-82.

Timber Production LUD

Goals

- Maintain and promote industrial wood production from suitable timberlands, providing a continuous supply of wood to meet society's needs.
- Manage these lands for sustained long-term timber yields.
- Seek to provide a supply of timber from the Tongass which meets the annual and planning-cycle market demand, consistent with the standards and guidelines of this land use designation.

Objectives

Locate and design timber harvest activities to meet timber objectives. Suitable forest lands are available for timber harvest activities; appropriate silvicultural systems may be used. Other timber management objectives include:

- Seek to reduce clearcutting when other methods will meet land management objectives.
- Use forest health management to protect resource values.
- Improve timber growth and productivity on commercial forest lands.
- Plan, inventory, prepare, offer, sell, and administer timber sales and permits to ensure the orderly development of timber production.

Desired Condition

Suitable timber lands are managed for the production of sawtimber and other wood products on an even-flow, long-term sustained yield basis; the timber yield produced contributes to a Forest-wide sustained yield. An extensive road system provides access for timber management activities, recreation uses, hunting and fishing, and other public and administrative uses; some roads may be closed, either seasonally or year-long, to address resource concerns. Management activities would generally dominate most seen areas. Tree stands are healthy and in a balanced mix of age classes from young stands to trees of harvestable age, often in 40- to 100-acre stands. Recreation opportunities, associated with roaded settings from Semi-primitive to Roaded Modified, are available. A variety of wildlife habitats, predominantly in the early- and middle-successional stages, are present.

Old-growth Habitat LUD (No treatments proposed in this LUD)

Goals

- Maintain areas of old-growth forests and their associated natural ecological processes to provide habitat for old-growth associated resources.
- Manage early seral conifer stands to achieve old-growth forest characteristic structure and composition based upon site capability.

Objectives

- Provide old-growth forest habitats, in combination with other land use designations, to maintain viable populations of fish and wildlife species that may be closely associated with old-growth forests.
- Contribute to the habitat capability of fish and wildlife resources to support sustainable human subsistence and recreational uses.
- Maintain components of flora and fauna biodiversity and ecological processes associated with old-growth forests.
- Apply silvicultural treatments to accelerate forest succession to achieve old-growth forest structural features.
- To the extent feasible, limit roads, facilities, and permitted uses to those compatible with old-growth forest habitat management objectives.

Desired Condition

All forested areas within this LUD have attained old-growth forest characteristics. A diversity of old-growth habitat types and associated species and subspecies and ecological processes are represented.

Areas Not Available for Harvest

Standards and guidelines delineate spatial areas (beach and estuary buffer, high hazard soils, high vulnerability karst and caves, riparian, greater than 72 percent slopes, and fish habitat) not available for programmed timber harvest within LUDs. Each standard and guideline applies to a specific habitat or ecological component. Detailed information about these and other standards and guidelines are included in Appendix G of this FEIS and Chapter 4 of the Forest Plan, and are incorporated in this FEIS by reference. Other areas not available for harvest include water, non-National Forest System land, sites supporting non-industrial tree species, areas where irreversible damage could occur, and area not capable of producing 20 cubic feet per acre per or more. Table 1-2 itemizes land classifications and summarizes the processes used to identify lands suitable and available for harvest and timber management.

Suitable and Available Lands

The project area contains National Forest System lands that have been classified using LUDs, Forest Plan Standards and Guidelines for resource protection, and vegetative cover. The following discussion is intended to show the amount of land that is covered by forest, with further divisions to show the amount of land that is capable of timber production and currently available for harvest. Appendix A in the Forest Plan describes the process used to identify the land suitable for timber production.

In the Timber Production LUD portion of the project, beach and estuary fringe areas, high vulnerability karst, RMAs, high hazard soils (MMI 4), non-forest and non-productive forest, and small old growth reserves total about 5,372 acres. These acres are considered unsuitable for timber production and have been removed from the suitable timber base.

Forest land that is suitable for timber production meets several criteria.

- Technology is available that will ensure timber production without irreversible resource damage to soils, productivity, or watershed conditions.
- There is reasonable assurance that the land can be adequately restocked following harvest.
- Timber production is an appropriate use under current management direction.

About 9,030 acres in the Timber Production LUD are considered suitable for timber production. About 5,293acres have been previously harvested and are too young for commercial thinning at this time. Although this second growth is on suitable land, harvest is not proposed at this time. The remaining 3,736 acres in the project area include land with productive old growth timber that is suitable and available[4] for harvest at this time.

Suitable and Available Timber Lands

Table 1-4 displays the suitable and available timber lands in the project area.

Table 1-4. Acres by suitability type

Suitability Type		Acres[a]
Project Area (total)		**17,730**
Lands not Suitable for Timber Production	Freshwater	*(81)*
	Non-National Forest System Lands:	*(830)*
	Process 1: Non-forest land	*(410)*
	Process 2: Non-industrial species	*0*
	Process 3: Irreversible Damage	*(37)*
	Process 4: All SMUs can be restocked in 5 yrs.	*0*
	Process 5: Non-productive land	*(597)*
	Process 6: Administrative Withdrawn LUDs, LUD2, TTRA buffers	*(1,370)*
Tentatively Suitable Lands		**14,405**
Tentatively Suitable Lands not appropriate for timber production	Old Growth Reserves (Medium and Large)	*0*
	Other LUDs not suitable	*(2)*
	1000 ft Beach Buffer	*(3,247)*
	330 ft Eagle Nest Buffer	*0*
	Riparian Management Area	*(474)*
	Small Old Growth Reserve	*(1,651)*
Suitable Lands		**9,031**
	(less managed stands – previously harvested young growth)	*(5,293)*
Suitable/Available[b] Lands		**3,738**

Source workspace: /fsfiles/office/gis/tuxekan/gis_spec_wksp/smog_strategies_suitability/
Source geodata: TUXESUIT2003 (clip of SEIS2003 Suitability Layer);TUXESUITFSOGR; TUXESUITIA
Source tables: tuxesuit2003.dat, tuxesuit2003.fre; tuxesuitfsogr.dat, tuxesuitfsogr.fre; tuxesuitia.dat, tuxesuit2003.fre
[a] Acres have been rounded to the nearest whole number and may create minor discrepancies.
[b] Available = acres that are available at this time. *Does not include young growth.*

[4] In this context "suitable *and* available" refers to suitable lands that have timber of harvestable age. This *does not include* young growth.

State and Private Lands

State and private lands ("Non-National Forest System Lands" in Table 1-4) are not designations in the Forest Plan. However, for purposes of this FEIS, private lands include those lands that have been conveyed to the State of Alaska or to Native corporations. These lands are considered where appropriate when analyzing cumulative effects.

Past, Present, Foreseeable Future Activities Relevant to the Tuxekan Island Project

History of Timber Harvesting

Clearcutting

Harvest to date has generally been by clearcutting of old-growth stands. Timber harvest on Tuxekan Island began in the 1920s, and since that time, approximately 7,428 acres of old-growth forest has been harvested and regenerated in the project area (Tuxekan Island) on NFS land. Timber harvest peaked in the 1960s and 1970s, declined during the 1980s, and continued at lower levels through the 1990s and 2000s. Harvest before the mid-1940s was focused on areas accessible from the beach (although not all in the beach fringe). The harvest from the mid-1940s to the late 1970s was focused on the northern and central part of the island. Harvest from the late 1970s through the early 1990s was mostly on the southern part of the island (Figure 1-2) and Table 1-5).

Table 1-5. Past harvest acres on Tuxekan Island

Years of harvest	Acres Harvested		
	On NFS land[a]	On private and State land	Total
1920-1929	4	0	**4**
1930-1939	7	0	**7**
1940-1949	712	0	**712**
1950-1959	31	117	**148**
1960-1969	2,408	14	**2,422**
1970-1979	2,566	233	**2,799**
1980-1989	1,482	52	**1,534**
1990-1999	149	0	**149**
2000 to present	69	0	**69**
Total	**7,428**	**416**	**7,844**

[a] Harvesting began on the Island prior to Forest Planning, and associated land management area designations and determinations of suitability. Some of the acreage displayed in the table is now considered unsuitable for timber production under the current Forest Plan.

It should be noted that the watershed boundaries defined in Figure 1-2 have been modified from conventionally defined watershed boundaries (hydrologic unit codes) in order to account for the influence of karst-related groundwater hydrology. The influence of past management activities on karst is discussed under "Summary of Existing Harvest and Roads on Carbonate".

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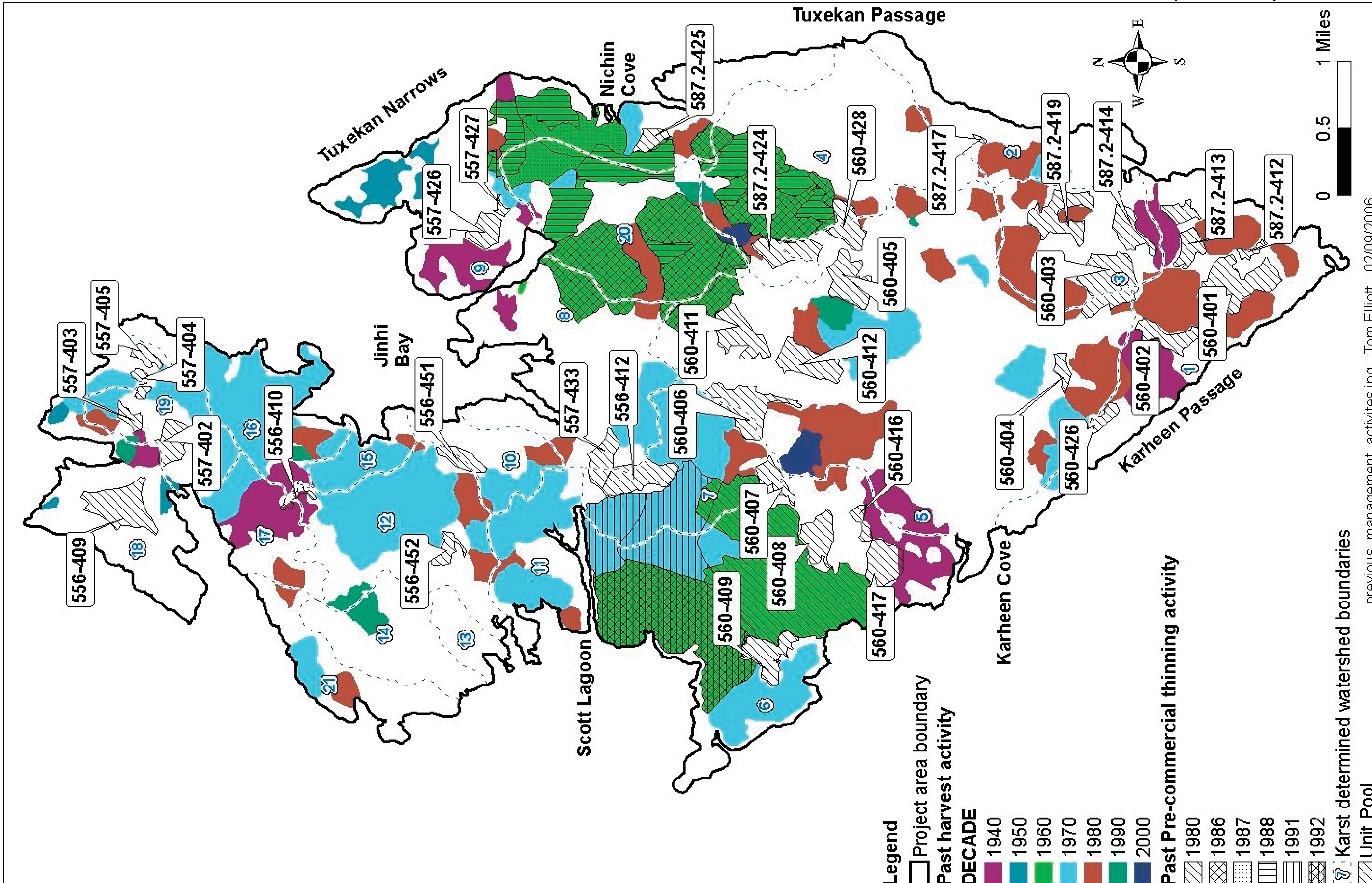

Figure 1-2. Previous management activities in the Tuxekan project area

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Approximately 21 percent of the total riparian management area was harvested prior to 1990. Past harvest was on about 19 percent of the total Class I and II stream mileage in the project area. There have been about 1,730 acres of harvest in the beach/estuary buffer, mostly on the west side of the island (Figure 1-2). Twenty-two percent of the timber located on carbonate rock has been harvested prior to the proposal of this project (*Chapter 3, Issue 1*).

Pre-Commercial Thinning

There have been approximately 2,145 acres of pre-commercial thinning done on the entire island, from the 1980s to 1990s. This equates to approximately 35 percent of the previously harvested units having been thinned, usually to a spacing of 12-feet by 12-feet or 14-feet by 14-feet to improve growth of remaining trees, discourage disease, and to adjust species composition. Approximately 1,291 acres of pre-commercial thinning in young stands are under contract for the next few years. Ten percent of precommercial thinning is generally targeted to improve wildlife habitat and one percent to improve riparian habitat.

Table 1-6. Acres of precommercial thinning on Tuxekan Island by VCU and Decade

VCU	Decade	Acres
556	1980s	35
	1990s	351
557	1980s	692
560	1980s	407
587.2	1980s	660
	Total	**2,145**

Purpose and Need

Purpose of the Project

The purpose of the Tuxekan Project is to move the project area towards the desired condition described by the Forest-wide goals and objectives and project-specific land use designation (LUD) goals, objectives, and desired conditions. Applicable Forest-wide goals and objectives are found in the Forest Plan, pp. 2-3 and 2-4. The LUDs specific to the Tuxekan Project are Timber Management and Old-growth Habitat (no harvesting proposed in this LUD). See pages 1-6 and 1-7 above, for the goals, objectives, and desired condition pertinent to these LUDs. In addition to Forest Plan Standards and Guidelines, circumstances specific to the project area also influence management activities.

Need for the Project

Based on the goals, objectives, and desired condition for the Timber Production and Old-growth Habitat LUDs, the following needs have been identified to move the Tuxekan Project Area towards the Forest Plan desired condition.

- Manage the timber resource for production of sawtimber and other wood products from suitable timber lands made available for timber harvest on an even-flow, long-term, sustained-yield basis and in an economically efficient manner.
- Seek to provide a timber supply sufficient to meet the annual market demand for Tongass timber and the market demand for the planning cycle.
- Provide a diversity of opportunities for resource uses that contribute to the local and regional economies of Southeast Alaska.
- Support a wide range of natural resource employment opportunities within Southeast Alaska's communities.
- Maintain a Forest-wide system of old-growth forest habitat to sustain old-growth-associated species and resources and ensure that the reserve system meets the minimum size, spacing, and composition criteria.

Appendix A provides information on how this project relates to the overall proposed Tongass timber sale program and why the project is being scheduled at this time.

Decisions to be Made

Mr. Forrest Cole, Forest Supervisor of the Tongass National Forest is the Deciding Official for this project. The scope of the project analysis and the decisions to be made are limited to the Tuxekan Project Area. The Forest Supervisor will use the Tuxekan FEIS as a basis to make informed decisions (limited to the Tuxekan Project Area) on the following:

a. Selection of the alternative that would best move the Tuxekan Island Project Area towards the desired condition per Forest Plan direction (pp. 3-144 to 3-150) and address the needs and issues identified for this project.
b. Whether a non-significant Forest Plan amendment would be required to implement the selected alternative (required when making changes to Forest Plan designated small old-growth reserves).
c. Whether additional mitigation measures and monitoring requirements outside the Forest Plan would be applied to the proposed activities.

If an action alternative is selected, project implementation could begin in the spring of 2007 and last for several years.

Public Involvement

In addition to the following specific activities, this project has been listed on the Tongass Schedule of Proposed Actions (SOPA) and included in the Tongass 10-Year Timber Sale Action Plan since 1999, and is on the 2006 5-Year Timber Sale Plan. The Schedule of Proposed Action and the 2006 5-Year Timber Sale Plan are both available on the Internet (http://www.fs.fed.us/r10/tongass/projects/projects.shtml). Project scoping announcements were printed in the Ketchikan Daily News on April 4, 2000, and in the Island News on April 10, 2000.

A Notice of Intent was published in the Federal Register on April 3, 2000, to announce that an environmental impact statement would be undertaken for the project.

In April 2000, a letter was mailed to approximately 139 individuals and groups that had previously shown interest in Forest Service projects in Southeast Alaska, seeking information and public comment. The letter was mailed to federal and state agencies, Alaska Native groups, municipal offices, businesses, interest groups, and individuals. The Forest Service received sixteen (16) responses to this mailing.

Public meetings for the project were held in Klawock (April 4, 2000), Thorne Bay (April 6, 2000), Naukati (April 9, 2000), and Edna Bay (April 10, 2000). These meetings were to provided project area information, presented the proposed project, and discussed local concerns and interests that concerned the project analysis.

Phone conversations with18 knowledgeable subsistence users, representing six communities located on northern Prince of Wales Island, Cleveland Peninsula, and Kosciusko Island were used to confirm and update information regarding subsistence activity obtained from specific communities in the region (URS 2002h). Notice of formal subsistence meetings was sent in July 2005 to several agencies, advisory committees and tribes. These meetings were held in Naukati on August 22 and in Craig on August 23, 2005. No publics attended either meeting. A Tlingit tribal elder from Klawock telephoned on August 22 to express concern for tribal cultural resources and traditional cultural properties on Tuxekan Island. The elder's concerns have been addressed through tribal consultation and cultural resource protection measures which are discussed elsewhere in this document. (Terry Fifield contacted Clara Peratrovich, the Tlingit elder in Klawock who raised the concern. Mr. Fifield reviewed the geography of the study area with Ms. Peratrovich as well as the locations of all know traditional gravesites in the study area. Clara's concerns were focused on the Tlingit village site of Tuxekan, which is not on Tuxekan Island, and on "Chief Tonowek's Grave", which is also not on Tuxekan Island. Fifield also explained that the 1000 foot coastal buffer would protect any undiscovered sites on the shoreline of Tuxekan Island. Clara was satisfied with the explanation but concerned that other developments might affect similar sites.)

Consultation with Agencies, Communities, Native Groups, and Others

The USDA Forest Service is committed to working closely with other agencies in order to foster collaborative stewardship and identify mitigation measures to prevent possible harmful environmental effects. The USDA Forest Service is responsible for coordinating the review of the project by several other agencies. Several meetings of an interagency team composed of Alaska Department of Fish and Game, U.S. Fish and Wildlife Service, and USDA Forest Service biologists were held to propose adjustments to old-growth reserve boundaries in the project area. The following state and federal agencies and federally recognized tribal governments were consulted about this project:

- Alaska Department of Fish and Game (ADF&G)
- Alaska Department of Environmental Conservation (ADEC)
- Alaska Division of Governmental Coordination (ADGC)(Currently this agency is part of the AK DNR)
- U.S. Environmental Protection Agency (EPA)
- U.S. National Marine Fisheries Service (NMFS)
- U.S. Army Corps of Engineers (USACE)

- U.S. Fish and Wildlife Service (USFWS)

Government to Government Consultation with Tribes

Consultation with tribal governments and ANCSA Corporations was conducted both in the context of government to government relations and to determine potential effects and concerns regarding archaeological and historic sites and traditional uses. The following Tribal governments and Native Corporations were consulted regarding the Tuxekan Project.

- Klawock Cooperative Association
- Craig Community Association
- Organized Village of Kasaan
- Hydaburg Community Association
- Klawock Heenya Corporation
- Shaan Seet Inc.
- Kavilco
- Haida Corp.
- Central Council of Tlingit and Haida Tribes of Alaska
- Sealaska Corporation

A letter was received form Sealaska Corporation June 13, 2001 agreeing with the recommendation of no direct adverse effect. In the letter Sealaska "reserves the right to comment when other aspects of the Tuxekan planning effort are published for public comment."

Draft and Final Environmental Impact Statement

The Tuxekan Timber Sale Project Draft Environmental Impact Statement (DEIS) was prepared by URS, a contracting firm, in 2001. The DEIS was initially issued for comment December 10, 2004. Because of inaccuracies in Appendices B and C, the road and unit cards, it was necessary to issue amended appendices on January 21, 2005, which initiated a new 45-day comment period that closed March 7, 2005. TEAMS Planning, a Forest Service enterprise group, in conjunction with Tongass National Forest resource specialists, have checked and updated the project for current conditions and information in preparation of the FEIS.

Eight individuals/organizations provided comments following the public comment period for the DEIS. The comments have been reviewed and included in the analysis for this FEIS. The FEIS has been modified to incorporate those comments. Responses to comments are included in Appendix H of the FEIS. The Notice of Availability of the FEIS will be published in the Federal Register and through a legal notice in the Juneau Empire, the paper of record for this project.

Subsistence Hearings

Hearings were held on August 22, 2005 in Naukati, Alaska, at the new Naukati School, and on August 23, 2005 in Craig, Alaska, at the Craig City Hall. No members of the public

attended either meeting. One phone call was received in response to the hearing notification, but did not relate to subsistence.

Federal and State Permits

Federal and State permits necessary to implement the authorized activities are found in Appendix G Supportive Information, Federal and State Permits, Licenses, and Certifications.

Issues

The Council on Environmental Quality (CEQ) NEPA regulations require the delineation of issues as detailed in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…"

Non-significant (resolved) Issues and Comments

Issues are considered non-significant, or resolved, if they fall in one of the following categories:

- Outside the scope of the proposed action;
- Already decided by law, regulation, Forest Plan, or other higher level decision;
- Irrelevant to the decision being made; or
- Conjectural and not supported by scientific or factual evidence - issues disputing Forest Service findings that are based on opinions and not scientific fact.

This section also includes suggestions, questions and requests that can be addressed in the analysis.

Issues Beyond the Scope of This Project

Some comments received during public involvement are not specific to this project or relate to decisions at a higher level of planning. These comments are found in the project file located at the Thorne Bay District Office, Thorne Bay, AK.

Additional Comments Received During Public Involvement

Other comments received during the public involvement period for the Tuxekan Project (see Tuxekan Project File) included: personal comments, requests for analyses or information, information on Tuxekan Island as a sacred Tlingit burial site (see *Chapter 3, Socioeconomic Environment, Heritage Affected Environment*), and requests for alternatives to the Proposed Action (see below). Comments received during public involvement can be found in the Tuxekan project file located at the Thorne Bay District Office, Thorne Bay, AK.

Suggestions were made to: eliminate clearcutting; provide small operator sales; eliminate road construction across high vulnerability karst; eliminate helicopter harvesting, have fewer roads, harvest only high-value timber units; and extend rotation for existing productive old growth and reserve corridors between small old-growth reserves. These suggestions are described under *Chapter 2, Alternatives Eliminated from Detailed Consideration*.

Significant (Unresolved) Issues Used to Develop Alternatives

A significant issue must be site specific, that is, relevant to and appropriately addressed at the project level.

Significant issues were identified through agency and public involvement. These are issues that could not be resolved by the application of Forest Plan Standards and Guidelines and BMPs, were not decided by previous decisions at a higher level, and are within the scope of this project. Similar issues were combined into one statement where appropriate. Once a significant issue was identified, measures were selected to compare how each alternative responds to the issue. Where possible, measures are quantifiable and were chosen with regard to predictability, responsiveness to the issue, and linked to the cause-and-effect relationship of the issue. The measures describe how the alternatives affect resources. Monitoring and mitigation of the anticipated environmental effects of the project were also designed to respond to significant issues.

Issue 1 - Watershed Health and Karst System Protection

Karst systems are formed by the dissolution of limestone and are characterized by sinkholes, caves, and connected underground drainages (for additional information, refer to Affected Environment, Ch. 3). Research in Alaska indicates that karst dominated aquatic systems have up to eight to ten times more productivity than non-karst associated systems. On Tuxekan Island, watershed processes and health are inseparably linked to that of karst systems found on the island. As a result, the issues for watershed and karst systems are listed together.

Ground disturbance due to timber harvesting and road building would result in increased cumulative effects to soils, hydrology, and karst features and systems within Tuxekan Project Area watersheds.

See *Comparison of Alternatives by Issues* section in *Chapter 2*, and *Issue 1 Watershed Health and Karst Systems* in *Chapter 3*.

This issue is addressed under Alternative 1, the No Action Alternative which does not include any timber harvest and road building. This issue is also addressed under Alternative 2 which restricts harvesting in areas of karst. Refer to *Chapter 2 –Alternatives* for more detail.

Table 1-7. Units of measure for Issue 1

Measurement Number	Measurement
Soil Productivity	
1SP1	Compliance with R10 Soil Quality Standards (USDA FS 1992).
1SP2	Soil productivity: Total acreage of detrimentally disturbed soil.
Hydrology	
1H1	Percent increase in disturbed acres from harvesting, temporary and NFS roads within Riparian Management Areas (RMAs).
1H2	Percent watershed disturbance by proposed and past timber harvesting and roads proposed or built between 1981 and 2011.
1H3	Acres of wetlands disturbed out of 2,661 acres of wetlands within the Tuxekan Project cumulative watershed effects area.
1H4	Total number of stream crossings.

Table 1-7. Units of measure for Issue 1

Measurement Number	Measurement
	Karst
1K1	Acres of proposed single-tree selection (STS) on carbonate.
1K2	Acres of proposed clearcut with reserves (CCR) on carbonate.
1K3	Acres of harvesting proposed on carbonate..
1K4	Percent increase of harvest acres on carbonate less than 30 years old by 2012
1K5	Miles of proposed NFS road on high vulnerability karst
1K6	Miles of proposed temporary road on high vulnerability karst
1K7	Miles of proposed temporary and NFS road on carbonate
1K8	Cumulative total number of road miles on carbonate (existing, decommissioned, and proposed)
1K9	Percent increase in miles of road on carbonate

Issue 2 - Timber Sale and Local Economics

The proposed project may not provide jobs and income benefiting local residents or provide a positive economic return to the timber sale purchaser.

See *Comparison of Alternatives by Issues* section in *Chapter 2*, and *Issue 2 Timber Sale and Local Economics* in *Chapter 3*.

This issue is addressed under Alternative 3 (modified proposed action) and Alternative 5. The modified proposed action includes the greatest number of harvest units of all the alternatives. Alternative 5 was created to include the greatest number of harvest units with adjustments made for road locations, harvest methods to reduce impacts to karst, and connectivity between small old-growth reserves. Refer to *Chapter 2 – Alternatives* for more detail.

Table 1-8. Units of measure for Issue 2

Measurement Number	Measurement
2TSE1	Number of direct jobs potentially supported
2TSE2	Direct income potentially supported ($)
2TSE3	Expected Bid Value ($)
2TSE4	Volume available for small sales (mbf)

Issue 3 – Wildlife

***3a**. The small old-growth reserves as originally mapped do not meet Forest Plan minimum requirements. There is concern that because of past harvest on the island habitat connectivity between small old-growth reserves would be further compromised.*

See *Comparison of Alternatives by Issues* section in *Chapter 2* and *Issue 3 Wildlife* in *Chapter 3*.

This issue is best addressed under Alternatives 4 and 5. Harvest units have been adjusted to fully incorporate the interagency recommendations for the small old growth reserves. Alternative 2 incorporates most of the interagency recommendations. Units have been adjusted or dropped in Alternatives 2, 4 and 5, maintaining connectivity between old growth reserves. Refer to *Chapter 2 –Alternatives* for more detail.

Table 1-9. Units of measure for Issue 3a

Measurement Number	Measurement
3aW1	Percent of the VCU in old-growth reserves
3aW2	Percent of old-growth reserve in productive old growth
3aW3	Analysis of connectivity between reserves

***3b**. Proposed harvesting in the project area would reduce high-value deer habitat adversely impacting subsistence users.*

See *Comparison of Alternatives by Issues* section in *Chapter 2*, and *Issue 3 Wildlife* in *Chapter 3*.

Table 1-10. Units of measure for Issue 3b

Measurement Number	Measurement
3bW1	Results of the deer model (habitat capability[a], deer/sq. mile) with predation
3bW2	Acres of high-value deer habitat available

[a] habitat capability is defined as the long-term potential of an area to support animals rather than an estimate of actual numbers present.

Chapter 2 – Alternatives

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Chapter 2 – Alternatives

Introduction

This chapter presents the alternatives in comparative form, sharply defining the issues and providing a clear basis for choice among options to the responsible official and the public (40 CFR 1502.14). A total of ten alternatives were considered by the Interdisciplinary (ID) Team. Five were eliminated from detailed study (see below), and the following five were considered in detail:

- Alternative 1 is the No Action alternative, under which the project area would have no timber harvesting or road construction at this time and would remain subject to natural and ongoing changes only.
- Alternative 2 addresses concerns regarding management activities in watersheds and effects to karst.
- Alternative 3 is the Modified Proposed Action (see Alternative 3 below). It addresses the concerns of the proposed activities on economics.
- Alternative 4 addresses concerns of the proposed activities on wildlife.
- Alternative 5 addresses concerns of the proposed activities on wildlife and economics.

Maps of all alternatives considered in detail are provided along with the discussions of the alternatives. The map for Alternative 1 (No Action) represents the current condition of the project area. Larger scale maps of the alternatives are contained in the project planning record.

Information used to compare alternatives at the end of Chapter 2 is summarized from *Chapter 3 - Affected Environment, Direct/Indirect & Cumulative Effects.*

The process used to develop alternatives can be found in Appendix G. Other supportive information originally found the DEIS Chapter 2 can now be found in Appendix G.

Alternatives Eliminated From Detailed Consideration

Several alternatives were considered during the planning process but were eliminated from detailed study and are not being carried forward. These alternatives are described briefly below, along with the reasons for not considering them further.

Alternatives to Clearcutting

Create an alternative that avoids clearcutting as the harvest method (URS 2001a).

Tuxekan Island is subject to severe winds, as described elsewhere in the document, and the windthrow potential is high for partial canopies that would remain after all but very light partial harvesting (MBG 2001). One study indicated that wind was responsible for approximately one-fourth of the annual tree mortality in Southeast Alaska during a seven-year period (Hutcheson et al. 1975). During the course of timber stand examinations for this project, stands were evaluated for windthrow hazard. One unit has extreme potential for windthrow. Three units have very high potential for windthrow. Twenty-six units have high

potential, while two units have moderate-high potential, and seven units have moderate potential for windthrow. No units in the project area are considered to have low potential for windthrow. Minimizing windthrow improves protection of watershed values by limiting siltation into aboveground streams, as well as protection of karst features and associated belowground hydrologic systems.

The Forest Plan requires that stands be left windfirm after harvesting. Therefore, it is not feasible to develop an alternative made up of only partial harvesting for this island, due to concerns over windthrow. Instead, partial harvesting is considered on a unit-by-unit basis in the action alternatives.

In addition, the CCR prescription (a two-aged management system), and the application of standards and guidelines for marten and goshawk, which utilize the 1:1 acre ratio of retention in unharvested blocks reduces that amount of clearcutting dramatically. For these reasons, no additional alternative is necessary to address this concern (*FEIS, Chapter 3, Other Resources, Vegetation Management, p. 3-140*).

For these reasons, this alternative has been eliminated from further consideration.

Small-operator sales

Create an alternative that would provide small-volume sales (typically less than 1 million board feet [mmbf]) only to small operators in order to maximize the benefit to local businesses (URS 2001a).

Consideration of such an alternative raised several concerns. First, parts of the unit pool may require road construction or reconstruction to make timber harvesting feasible. Small operators may not accumulate enough revenue to cover the cost of the planned construction and reconstruction, thus excluding the operators for whom the alternative was intended. Second, some of the units are feasible for harvesting only by helicopter, and typically the small operator cannot afford helicopter logging.

To maximize the opportunities for small operators, individual harvest units that would likely be of interest to small operators are identified in the unit cards. Units appropriate for small sales typically involve less expensive conventional logging methods and sufficient value to cover mobilization costs. At this time, however, reserving units along new or existing roads for small sales would jeopardize the economic viability of a large timber sale by limiting appraisal options. Units appropriate for small sales typically involve less expensive conventional logging methods and sufficient value to cover mobilization costs. These units may be needed to create an economically viable large sale. The needs of small operators would be better met by providing a variety of sale opportunities, rather than by restricting an entire alternative to small sales only. A detailed discussion regarding the available volume for small operators is given in “Issue 2: Timber Supply and Economics.”

For these reasons this alternative has been eliminated from further consideration.

High Vulnerability Karst

Create an alternative that avoids road construction across high vulnerability karst and construction adjacent to high vulnerability features.

Potential harvest units would be in, out, or modified to fit the frameworks of the action alternatives considered in detail. In the DEIS, Alternative 2 was developed to address timber harvesting and road building effects to soils, hydrology, and karst features and systems (Issue 1). Alternative 5, developed following public comment on the DEIS and additional field work, also addresses Issue 1 by eliminating some roads, modifying some prescriptions, and changing harvest methods.

In June of 2005 Forest Service personnel conducted additional field surveys of karst features (Baichtal, 2005, pers. com.) and proposed road relocations (Emley, 2005, pers. comm.). A number of the proposed road locations were changed to avoid areas of both moderate and high vulnerability karst (Table 1-2). As a result, there is no road construction proposed on high vulnerability karst in any action alternative.

These adjustments represent the best option for avoiding impacts to karst features and the overall system while still providing access to areas where timber harvest is allowed under the Forest Plan.

None of the action alternatives would compromise karst resource values by temporary or NFS road construction or harvesting proposals, and for these reasons this alternative has been eliminated from further consideration.

No helicopter harvesting, fewer roads, and harvesting only high value timber units

Create an alternative based on a timber financial efficiency analysis and address the need to minimize impacts to fisheries, high-value marten, deer and marbled murrelet habitat, and wetlands by reducing timber harvesting beyond the levels in Alternative 4; and configuring the project to maximize economic efficiencies - removing areas that would be logged by helicopter and building fewer miles of new roads.

The current range of alternatives address concerns for wildlife habitat and old-growth connectivity (Alternatives 4 and 5), watershed and karst concerns (Alternative 2), and meeting Forest Plan goals for the timber LUD. A financial efficiency analysis was done for the project (see Logging Systems and Transportation Analysis, Tuxekan Island EIS, URS, 2001), identifying units that would yield a positive stumpage even in a low market. Many of the units identified with a positive stumpage during a low market are those that are planned for conventional logging systems with minimal road construction costs.

While it is true that a viable timber sale could be created by including only units that minimize new road construction and have high net stumpage values, this would not meet the goals and objectives of the Timber Production Land Use Designation (LUD) that the majority of the project is located in. One of the Forest Plan goals stated for the timber production LUD is "to manage these lands for sustained long-term timber yields". By harvesting only units with a high stumpage value and little or no road construction, the economics of future entries could be adversely affected. In order "to manage these lands for sustained long-term timber yields", units with high stumpage values need to be balanced with those having lower stumpage values.

Another objective within the timber production LUD is to "plan a transportation network of roads and helicopter access that will eventually access most of the suitable timber lands for standard logging or helicopter yarding systems". By harvesting only units with little or no

new road construction, the transportation system would not be moving towards this objective. This option would pass on road construction costs and helicopter yarding costs to future projects while removing the highest value units with this entry.

For these reasons this alternative has been eliminated from further consideration.

Extend rotation for existing Productive Old Growth (POG) and reserve existing corridors between Small Old-Growth Reserves (Small OGRs)

Harvesting remaining high-volume, low-elevation, old-growth timber would occur only over an extended rotation until surrounding second-growth forest stands could be expected to provide wildlife habitat characteristics currently being provided by old-growth. Also corridors that connect the remaining fragments of high-volume, old-growth timber would be preserved from further timber harvesting.

Alternatives 2, 3, 4 and 5 were designed to meet the purpose and need for the Tuxekan project, the extent of which is to move the project towards the desired condition described for the timber LUD in the Forest Plan. Extending the rotation would not meet the purpose and need for the project.

Thinning represents an investment in timber management for increased yield and improved forest health conditions as well as an improvement in wildlife habitat. Two thinnings, during the lifetime of the stand, are considered a normal practice in Southeast Alaska. An early thinning occurs at about 25 years to control stem density and species composition ("pre-commercial" thinning).

Precommercial thinning second-growth stands on the island is an on-going activity. Projects currently being completed include precommercial thinning 1,291 acres of second growth. Ten percent of this thinning is targeted to improve wildlife habitat and one percent to improve riparian habitat.

Stand growth simulation models for second growth on nearby Kosciusko Island (URS 2002b) indicate that a second thinning ("commercial" thinning) should begin around 65 years to maintain a high volume production rate. Stands harvested in the 1940s will reach this average age by 2010. Precommercial thinning has been and is being carried out in second-growth stands on Tuxekan. These have been positive cumulative effects because they improved growth and yield over a range of stand age classes and opened up the stands to improve habitat for wildlife.

The corridors between the Small OGRs have been considered and were used to develop Alternative 4. In addition, Alternatives 2 and 5 maintain these corridors to varying degrees.

For these reasons this alternative has been eliminated from further consideration.

Alternatives Considered in Detail

All action alternatives propose possible vegetative treatments that use acceptable silvicultural practices, follow Forest Plan Standards and Guidelines, and have a high probability of successfully achieving the desired condition for wildlife habitat and forest management sustainability.

See *Chapter 1, Background*, for the changes to road proposals between the DEIS and FEIS.

Detailed discussions silvicultural methods for clearcut with reserves (CCR) and single tree selection (STS) can be found in Appendix G. These prescriptions would be applied to Alternatives 2, 3, 4 and 5.

Alternative 1 – No Action (Figure 2-1)

Under Alternative 1 (Table 2-2), current and on-going management activities would continue, but no new, Forest Service harvest activities would be initiated during this entry. However, vegetation management activities such as precommercial thinning (including riparian thinning and wildlife thinning) will continue. Changes might occur through current management direction (such as road maintenance), natural processes, or other management decisions in the future. This alternative provides a foundation for describing and comparing the magnitude of environmental changes associated with the action alternatives against those changes that occur with no new federal action at this time.

Approximately 3,736 acres of mature commercial forest, that is currently suitable and available, exist within the project area on National Forest system lands. Existing Small OGRs would remain as mapped in the Forest Plan (2,458acres). Alternative 1 does not preclude timber harvesting from other areas at this time or from the project area at some time in the future.

Because the No Action Alternative does not include any timber harvest or road building, it responds to Issues 1 and 3b:

Issue 1:

Ground disturbance due to timber harvesting and road building would result in increased cumulative effects to soils, hydrology, and karst features and systems within Tuxekan Project Area watersheds.

Issue 3b:

Proposed harvesting in the project area would reduce high-value deer habitat adversely impacting subsistence users.

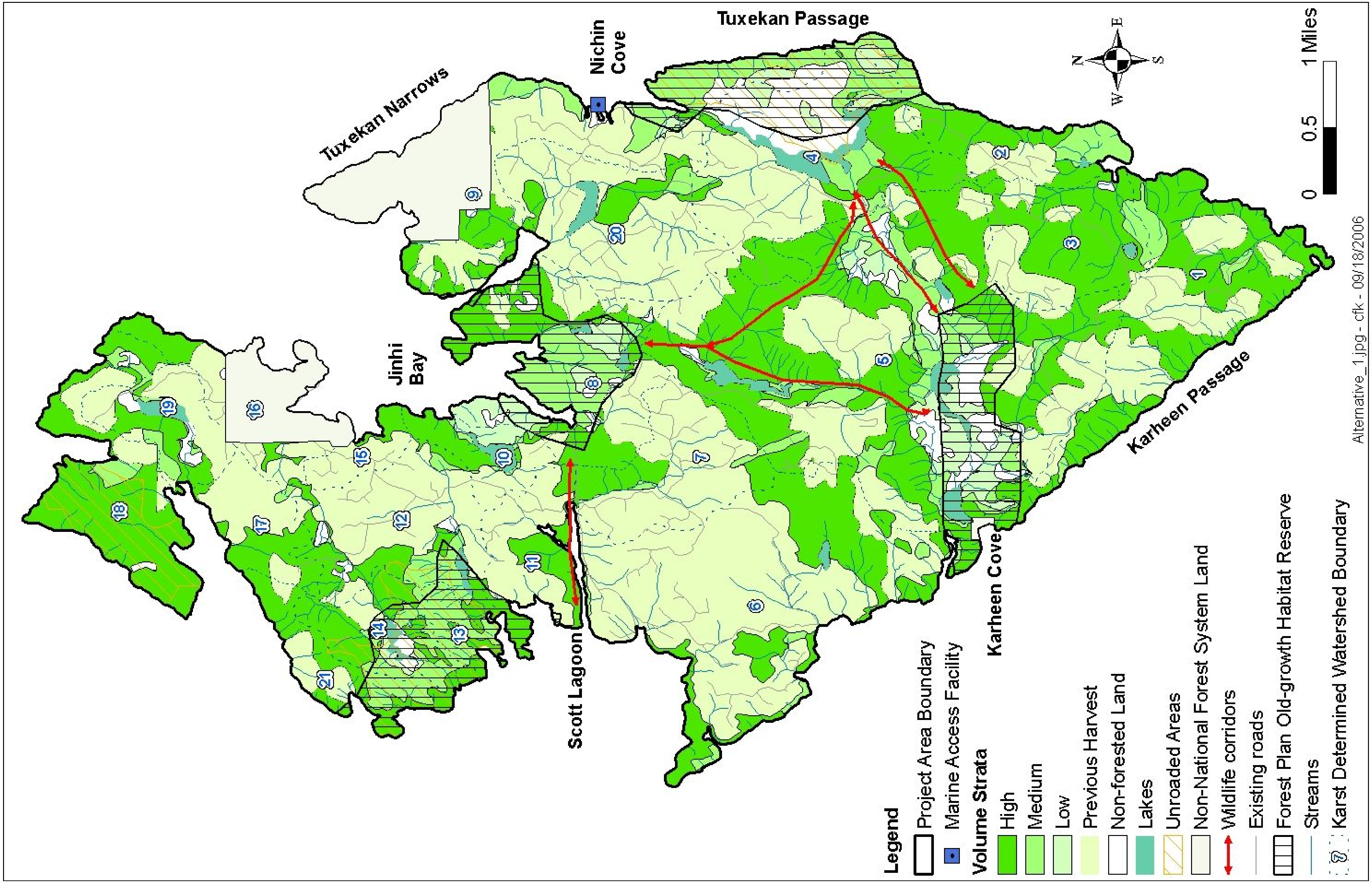

Figure 2-1. Alternative 1 (No Action)

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Alternative 2 (Figure 2-2)

Alternative 2 was developed by the interdisciplinary team to respond to issues regarding watersheds and karst raised during public scoping. Alternative 2 incorporates most of the interagency recommendations. Units have been adjusted or dropped in Alternative 2 (Table 2-1 and Table 2-2), maintaining connectivity between old growth reserves, eliminating effects to high vulnerability karst and mitigating effects to carbonates. The boundaries of the four small OGRs in the project area would be adjusted according to the interagency committee's recommendations, with minor revisions of the interagency small OGRs in VCUs 557 and 587.2 to accommodate harvest in two small areas.

Alternative 2 (Table 2-3) responds to Issue #1:

Ground disturbance due to timber harvesting and road building will result in increased cumulative effects to soils, hydrology, and karst features and systems within Tuxekan project area watersheds.

This alternative includes timber harvesting on approximately 441 acres that would produce an estimated harvest volume of 15.1 million board feet (mmbf). Approximately 6.2 miles of road construction (3.1 miles NFS; 3.1 temporary) would be needed to implement this alternative. Alternative 2 responds to this issue by:

- Reducing the total acres harvested;
- Reducing the clearcut acres;
- Reducing the total road construction; and
- Designating 3,913 acres of Small OGRs as listed in the "Old-growth Habitat Reserve Review" for Thorne Bay and Craig Ranger Districts, Tongass National Forest, May 2002 (USDA 2002).

All Alternative 2 activities are consistent with Forest Service Manual (FSM), Forest Service Handbook (FSH), Forest Plan standard and guidelines and Best Management Practices (BMPs). A non-significant Forest Plan amendment would be required to implement this project if Alternative 2 were selected. This would be required when making changes to small old-growth reserves. All proposed logging systems conform to Occupational Safety and Health Administration (OSHA) standards.

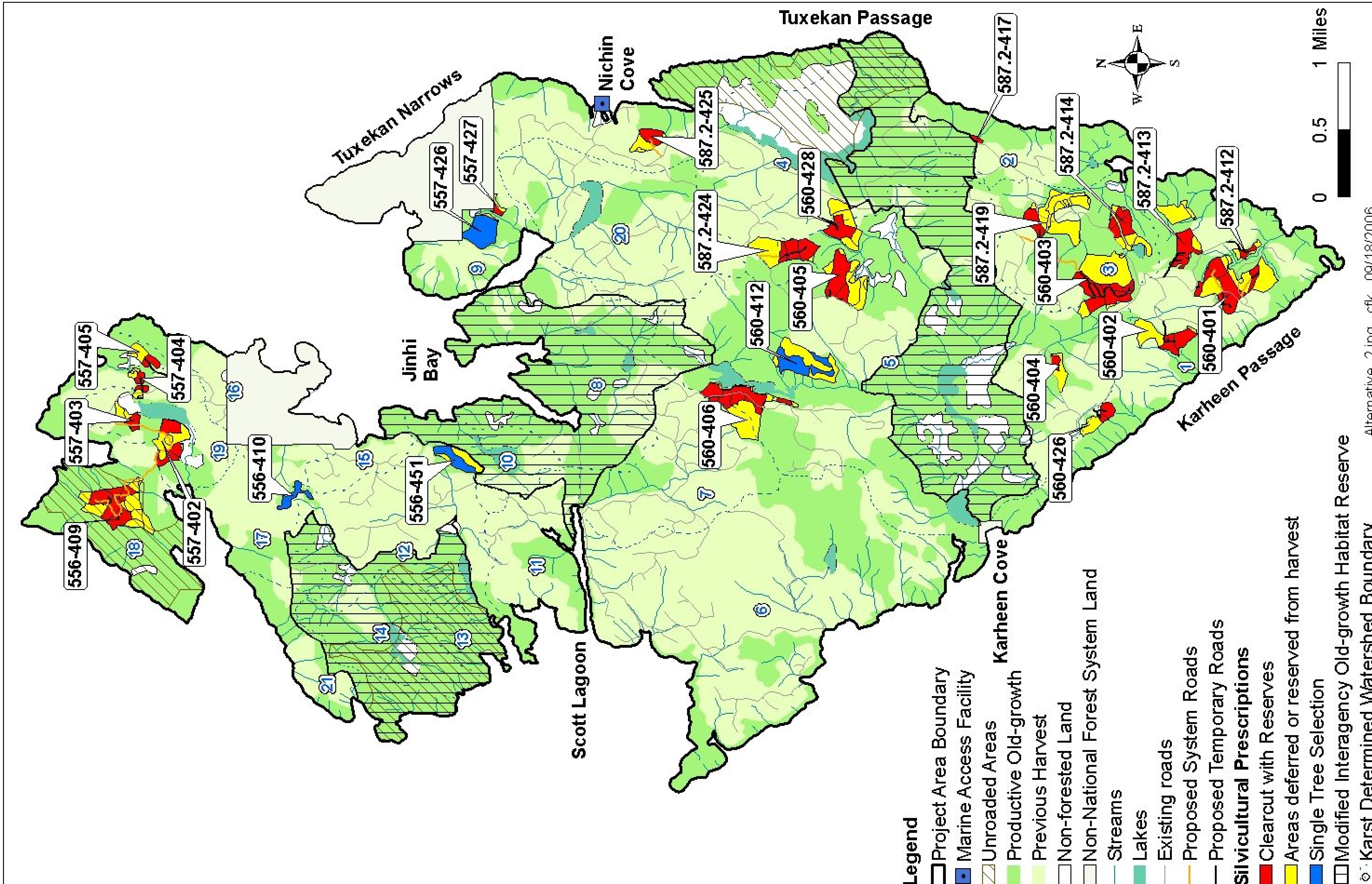

Figure 2-2. Alternative 2

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Alternative 3 – Modified Proposed Action (Figure 2-3)

Alternative 3 was developed by the interdisciplinary team based on a comparison of the existing conditions in the project area and Forest Plan direction. The Notice of Intent and subsequent public involvement for the Tuxekan Island Timber Sale Project (referred to as the Tuxekan Project) proposed timber harvesting on approximately 2,100 acres that would produce an estimated harvest volume of 20 million board feet (mmbf).[1]

Following additional fieldwork and analysis, a Modified Proposed Action (Alternative 3) was more clearly defined.

This alternative includes the greatest number of harvest units of all the alternatives (Table 2-1 and Table 2-2). It includes timber harvesting on approximately 570 acres that would produce an estimated harvest volume of 20.2 million board feet (mmbf). Approximately 9.6 miles of road construction (4.7 miles NFS; 4.9 temporary) and approximately 2.0 miles of road reconstruction would be needed to implement this alternative. By emphasizing timber supply and economics, Alternative 3 (Table 2-3) responds to Issue #2:

The proposed project may not provide jobs and income benefiting local residents or provide a positive economic return to timber sale purchasers.

- Includes the greatest number of harvest units of all action alternatives.

The boundaries of the four small OGRs in the project area would be adjusted in limited ways to include additional old-growth stands and high-value deer winter range, and to meet Forest Plan acreage requirements (3,935 Acres). All Alternative 3 activities are consistent with FSM, FSH, Forest Plan standard and guidelines, and BMPs. A non-significant Forest Plan amendment would be required to implement this project if Alternative 3 were selected. This would be required when making changes to small old-growth reserves. All proposed logging systems conform to OSHA standards.

[1] Information from: Tuxekan NOI, Federal Register, 3/20/2000 and Tuxekan scoping letter date, 4/1/2000

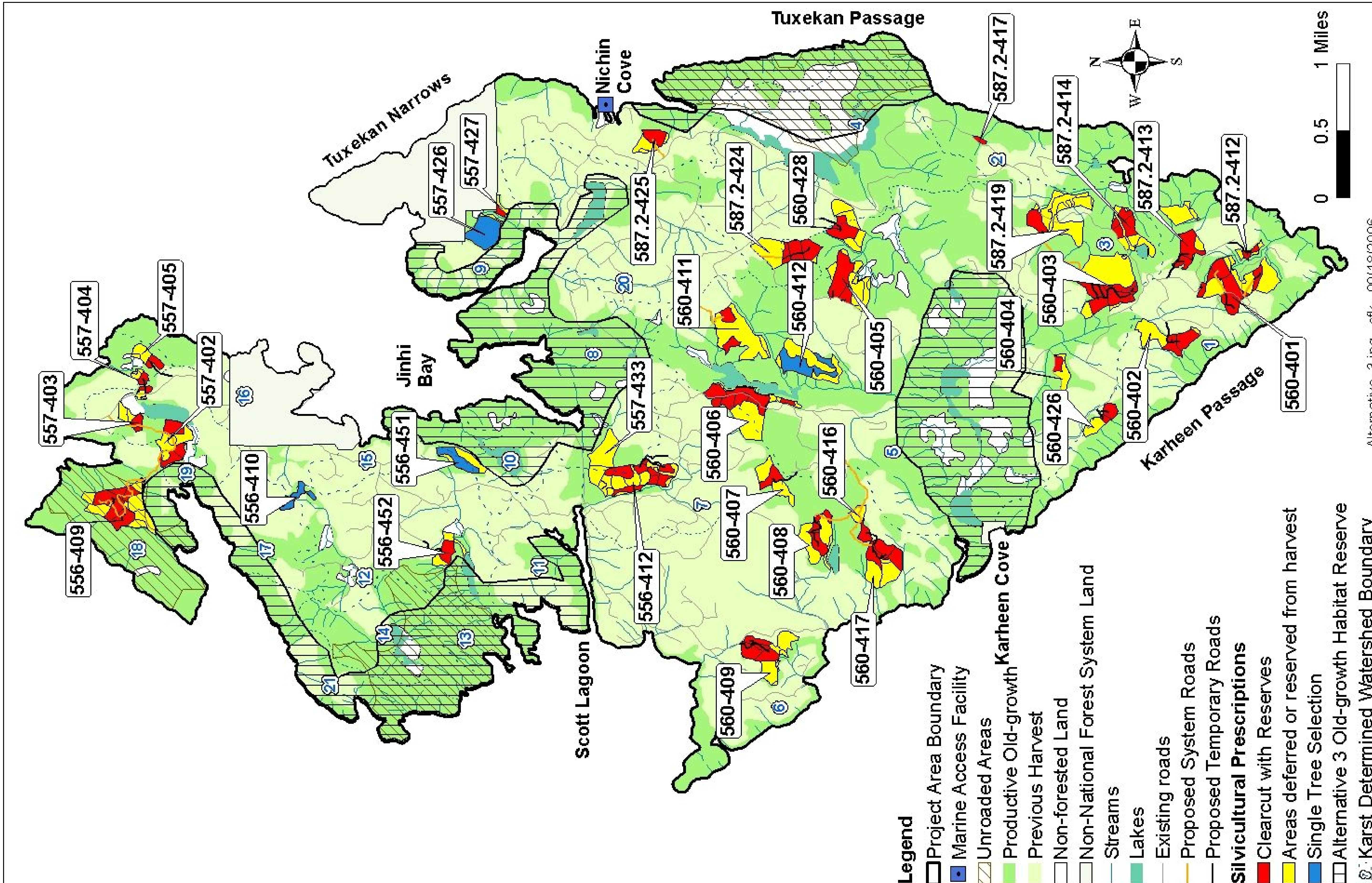

Figure 2-3. Alternative 3

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Alternative 4 (Figure 2-4)

This alternative was developed to respond to issues raised during public scoping regarding deer habitat connectivity. Harvest units have been adjusted to fully incorporate the interagency recommendations for the small old growth reserves. Units have been adjusted or dropped in Alternative 4 (Table 2-1 and Table 2-2), maintaining connectivity between old growth reserves.

Alternative 4 (Table 2-3) responds to Issue #3:

The small old growth reserves as originally mapped do not meet Forest Plan minimum requirements. There is concern that because of past harvesting on the island, habitat connectivity between small old-growth reserves would be further compromised.

This alternative includes timber harvesting on approximately 382 acres that would produce an estimated harvest volume of 12.4 million board feet (mmbf). Approximately 6.0 miles of road construction (3.9 miles NFS; 2.1 temporary) would be needed to implement this alternative. Alternative 4 responds to this issue by emphasizing:

- Retention of wildlife habitat;
- Old-growth connectivity in the interior of the island including designation of 3,942 acres of small OGRs as listed in the "Old-growth Habitat Reserve Review" for Thorne Bay and Craig Ranger Districts, Tongass National Forest, May 2002 (USDA 2002); and
- Greater opportunities for sustaining subsistence deer hunting.

All Alternative 4 activities are consistent with FSM, FSH, Forest Plan standard and guidelines, and BMPs. A non-significant Forest Plan amendment would be required to implement this project if Alternative 4 were selected. This would be required when making changes to small OGRs. All proposed logging systems conform to OSHA standards.

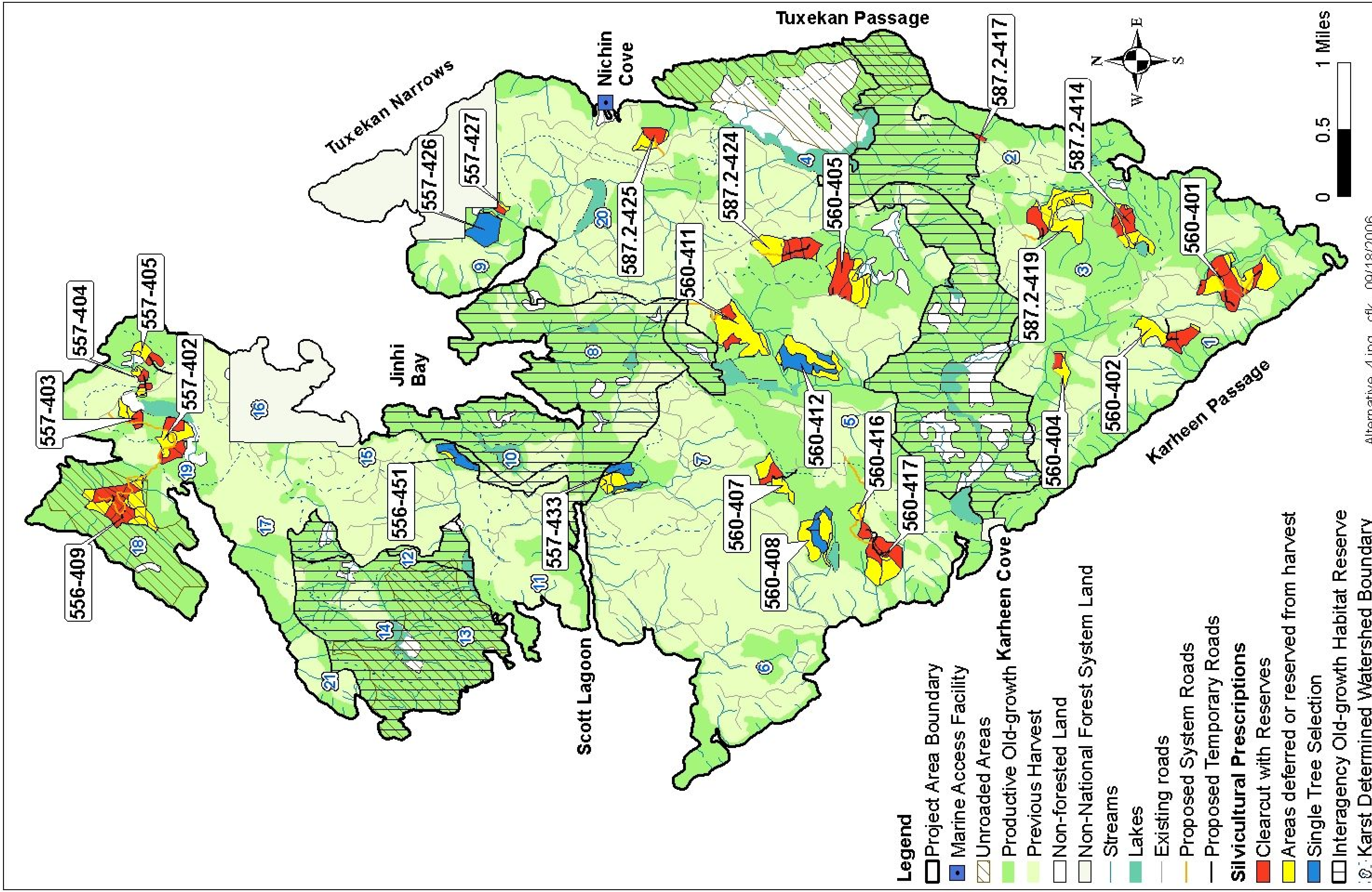

Figure 2-4. Alternative 4

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Alternative 5 (Figure 2-5)

Alternative 5 was developed by the interdisciplinary team in response to public involvement during the public comment period on the DEIS. Alternative 5 was created to include the greatest number of harvest units with adjustments made for road locations and harvest methods to reduce impacts to karst. Harvest units have been adjusted (Table 2-1 and Table 2-2) to fully incorporate the interagency recommendations for the small OGRs. Units have been adjusted or dropped in Alternative 5, maintaining connectivity between old growth reserves. The access to unit 587.2-412, the temporary access road of off FSR 1460030, has been eliminated in favor of a temporary road off of FSR 1460000. This new temporary location is shorter than the original temporary location and eliminates the need for 0.5 miles of maintenance on FSR 1460030. See Appendix B, Alternative 5: Unit 587.2412, p. App. 1-103.

Alternative 5 (Table 2-3) responds to Issue #3:

The small old growth reserves as originally mapped do not meet Forest Plan minimum requirements. There is concern that because of past harvesting on the island, habitat connectivity between small old-growth reserves would be further compromised.

It also responds to Issue #2:

The proposed project may not provide jobs and income benefiting local residents or provide a positive economic return to timber sale purchasers.

This alternative includes timber harvesting on approximately 523 acres that would produce an estimated harvest volume of 18.3 million board feet (mmbf). Approximately 8.8 miles of road construction (4.3 miles NFS; 4.5 temporary) and approximately 2.0 miles of road reconstruction would be needed to implement this alternative. Alternative 5 responds to these issues by emphasizing:

- Retention of wildlife habitat;
- Old growth connectivity in the interior of the island including designation of 3,942 acres of Small OGRs as listed in the “Old-growth Habitat Reserve Review” for Thorne Bay and Craig Ranger Districts, Tongass National Forest, May 2002 (USDA 2002); and
- Harvest units that ensure a cost effective result.

All Alternative 5 activities are consistent with FSM, FSH, Forest Plan standard and guidelines, and BMPs. A non-significant Forest Plan amendment would be required to implement this project if Alternative 5 were selected. This would be required when making changes to small OGRs. All proposed logging systems conform to OSHA standards.

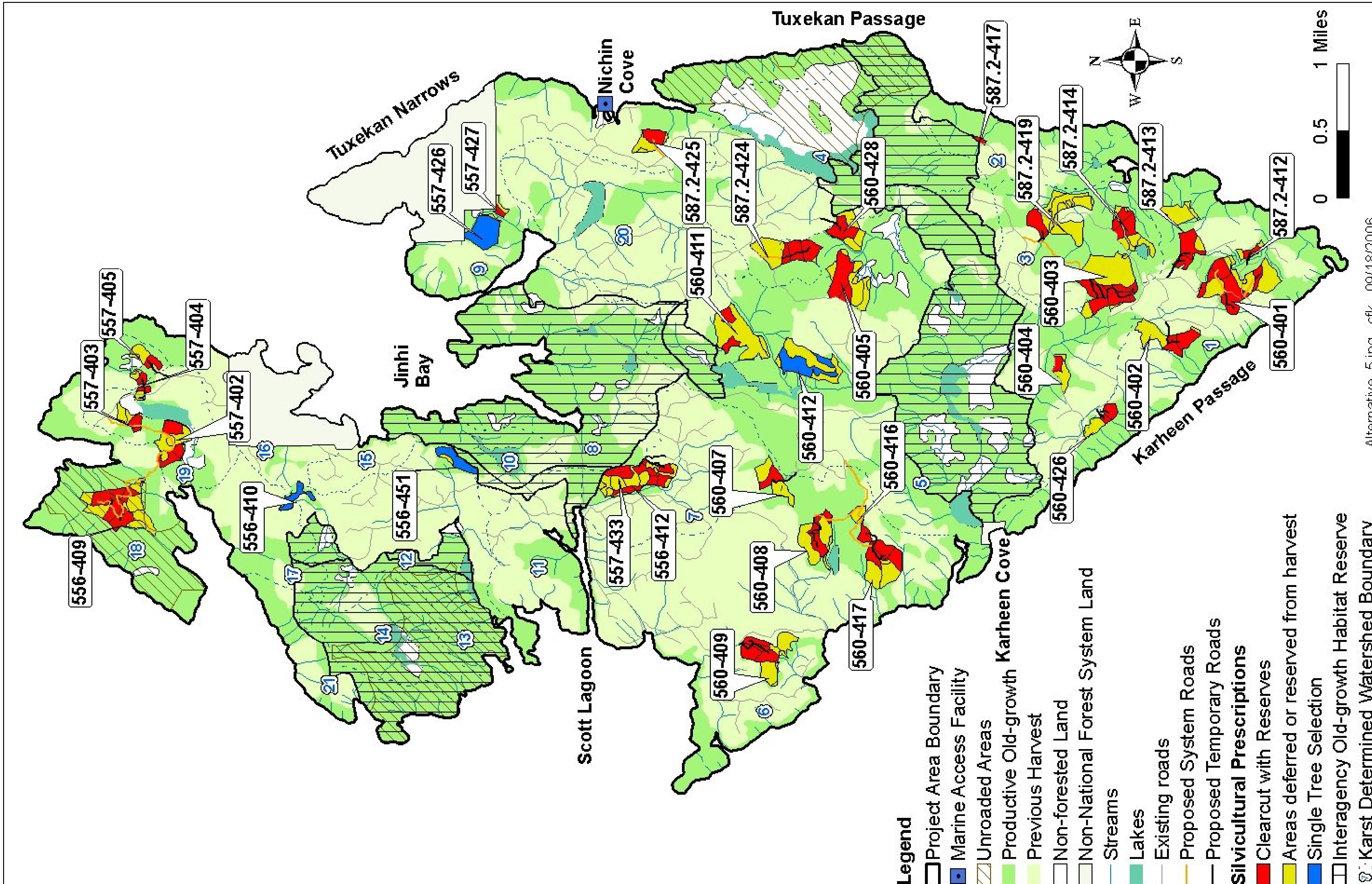

Figure 2-5. Alternative 5

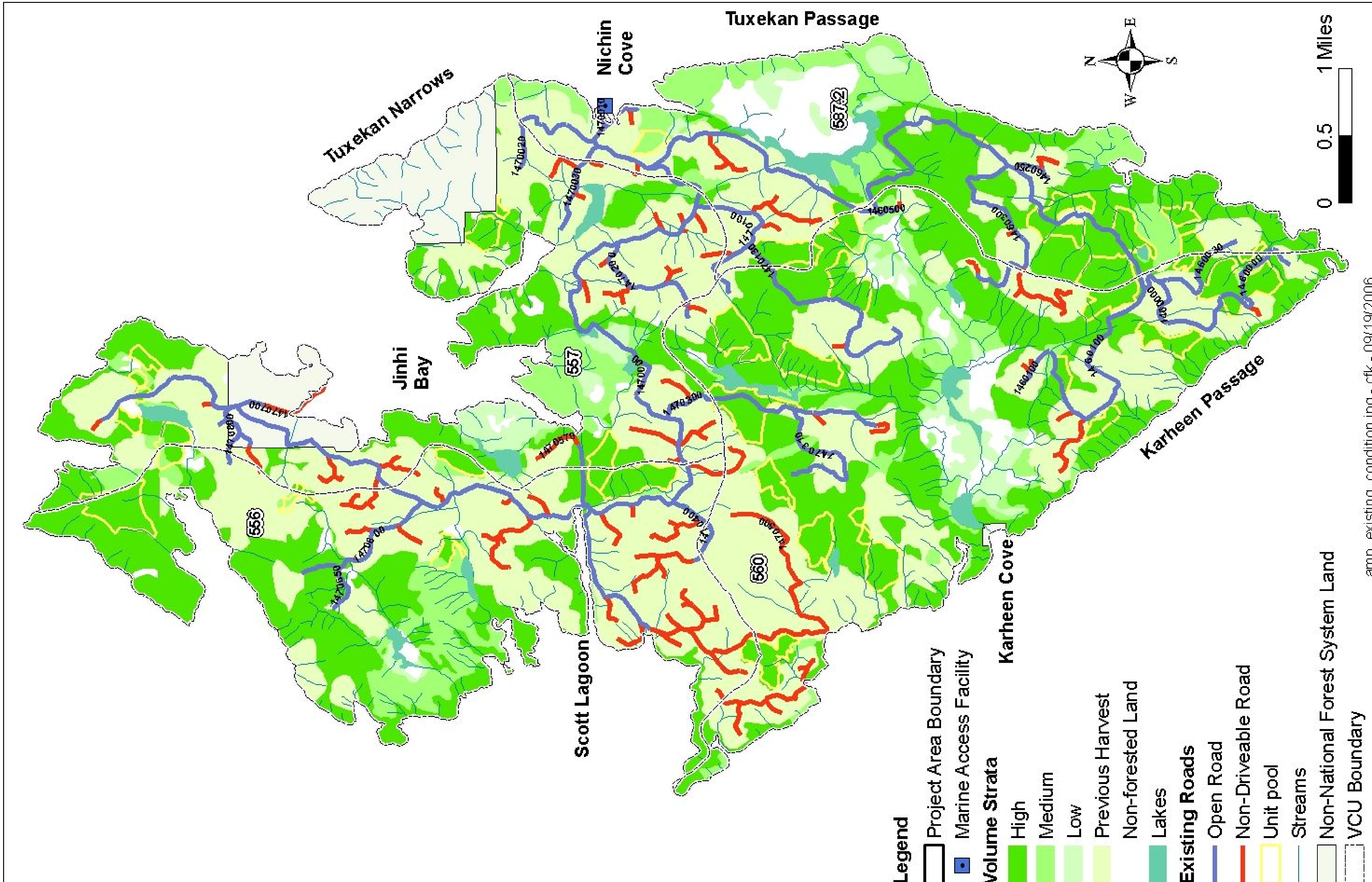

Figure 2-6. Tuxekan roads - existing condition

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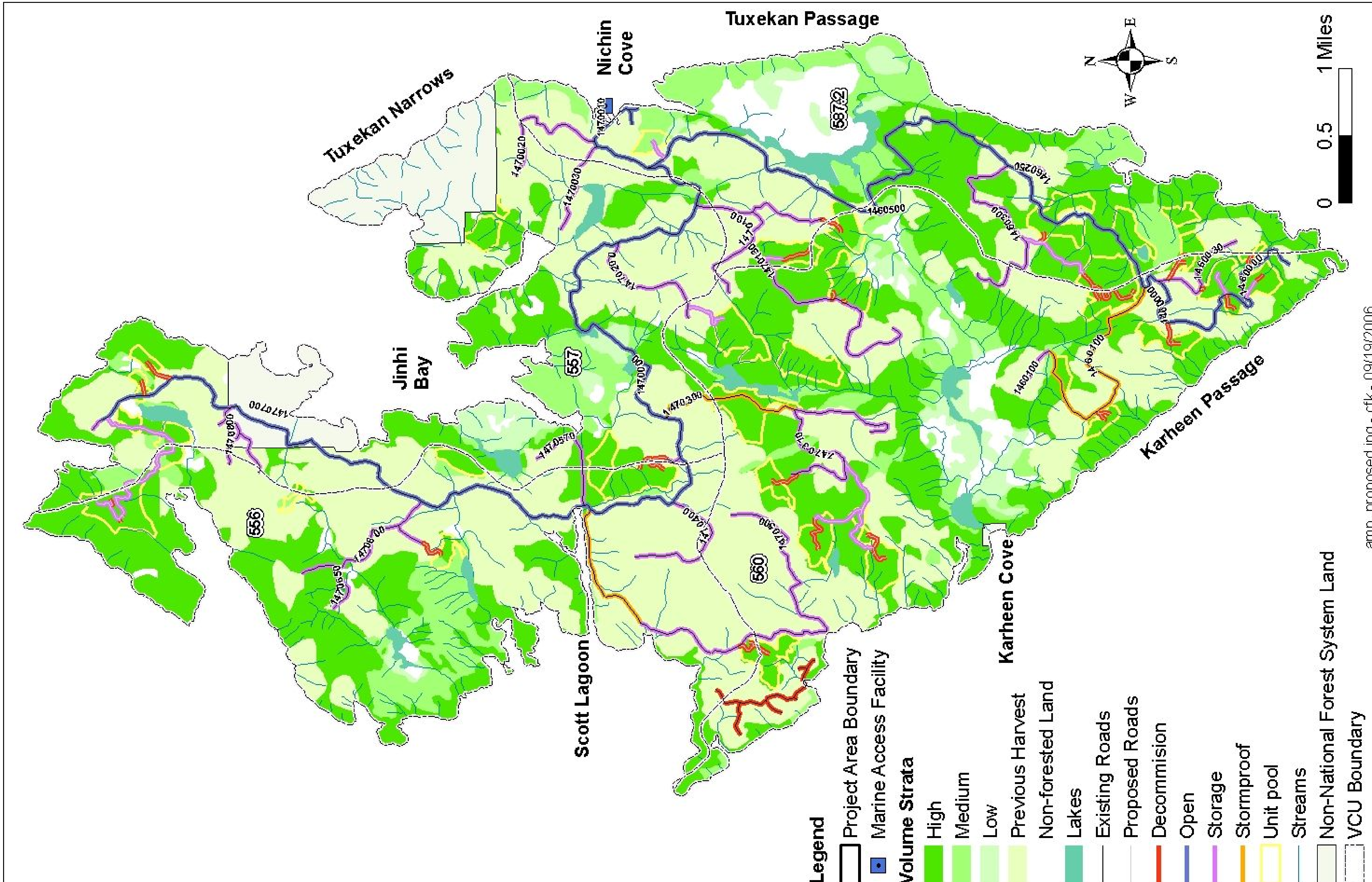

Figure 2-7. Tuxekan roads- proposed Access Management Plan

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Mitigation Measures

See individual resource sections in *Chapter 3* and *Appendices B, C,* and *D* for a full list of mitigation measures that could be used in the implementation of Alternatives 2, 3, 4 and 5 in addition to the generally applicable Forest and LUD standards and guidelines listed in the Forest Plan (pp. 4-1 through 4-122).

Comparison of Alternatives

Comparison of Alternatives by Forest Plan Direction, Needs, and Activities

The alternatives in the Tuxekan project meet Forest Plan goals and objectives (Forest Plan pp 3-144 to 3-150) relevant to this project and the needs identified for this project at different levels. The following discussion explains how the activities associated with the alternatives meet Forest Plan goals and the project-specific needs.

As described above in the detailed alternatives section above, differences between alternatives are found in harvest unit locations (See Table 2-1) and how well the locations respond to connectivity of habitat. Other differences between Alternatives 2 through 5 include using different combinations of clearcut with reserves (CCR) and single-tree (STS) harvesting prescriptions. Both prescriptions meet:

- Forest Plan goals of protecting soil and water (Forest Plan pp. 4-83 to 4-85), and
- Timber production LUD goals (Forest Plan p. 3-144):
    - Maintaining and promoting industrial wood production from suitable timberlands, providing a continuous supply of wood to meet society's needs;
    - Managing these lands for sustained long-term timber yields; and
    - Seeking to provide a supply of timber from the Tongass, which meets the annual and planning-cycle market demand, consistent with the standards and guidelines of this land use designation.

Potential harvest units would be in, out, or modified to fit the frameworks of the action alternatives considered in detail rather than by prohibiting road construction in these areas.

A comparison can be made as to how each alternative best meets Forest Plan goals and project-specific needs (Table 2-2) by quantifying and comparing activities for each alternative.

Table 2-1. Unit harvest information by alternative

VCU	Comp	Rx[a]	Planned Acres[b]	Unit Volume[c] MBF	Harvest Acres / Logging System[d]							
					Alt 2		Alt 3		Alt 4		Alt 5	
556	409	CCR	77	2017	38	S	38	S	38	S	38	S
	410	STS	10	70	10	HE	10	HE			10	HE
	412	CCR	34	437			17	S/SH			17	S/H
	451	STS	25	204	14	HE	14	HE	14	HE	14	HE
	452	CCR	18	217			9	S				
557	402	CCR	38	374	19	S	19	S	19	S	19	S
	403	CCR	13	233	6	S/SH	6	S/SH	6	S/SH	6	S/SH
	404	CCR	12	97	6	SH	6	SH	6	SH	6	SH
	405	CCR	13	243	5	S	5	S	5	S	5	S
	426	STS	29	293	28	HE	28	HE	28	HE	28	HE
	427	CCR	4	58	2	HE	2	HE	2	HE	2	HE
	433	CCR [e]	64	634			16	HE	16	HE	14 [f]	HE
560	401	CCR	84	1976	42	S/SH	42	S/SH	42	S/SH	42	S/SH
	402	CCR	36	771	18	S	18	S	18	S	18	S
	403	CCR	93	1121	41	S	41	S			41	S
	404	CCR	14	119	4	S	4	S	4	S	4	S
	405	CCR	58	791	29	S	29	S	29	S	29	S
	406	CCR	76	958	38	S	38	S				
	407	CCR	27	316			8	S	8	S	8	S
	408	CCR [e]	45	572			15	S/SH	15	HE	15	S/SH
	409	CCR	50	1072			24	S/SH			25 [g]	S/SH
	411	CCR	60	536			11	S/HE	11	S/HE	10 [g]	HE
	412	STS	57	426	26	HE	26	HE	26	HE	26	HE
	416	CCR	13	219			6	S	6	S	6	S
	417	CCR	49	1077			24	S/SH	24	S/SH	24	S/SH
	426	CCR	17	449	8	S	8	S			8	S
	428	CCR	39	736	19	S	19	S			15 [f]	S
587.2	412	CCR	8	93	4	S	4	S			4	S
	413	CCR	42	702	21	S	21	S			21	S
	414	CCR	35	497	17	S	17	S	17	S	17	S
	417	CCR	2	72	2	S	2	S	2	S	2	S
	419	CCR	63	331	12	S	12	S	12	S	12	S
	424	CCR	48	982	24	S	24	S	24	S	24	S
	425	CCR	20	224	10	SH	10	SH	10	SH	10	SH

[a] Rx (prescriptions): CCR = Clearcut with reserves; STS = Single-tree selection

[b] Planned acres include acres harvested and unit acres deferred or reserved for Forest Plan Standards and Guides, or for resource concerns.

[c] Unit volume represents potential volume for individual units in Alternatives 3 (modified Proposed Action) and 5 and may vary slightly by unit for a given alternative. Total potential volume displayed throughout the document includes volume from road clearing.

[d] Logging systems: S = Skyline; SH = Shovel: HE = Helicopter.

[e] Units 557-433 and 560-408 are STS prescriptions in Alternative 4 and CCR in Alternatives 3 and 5

[f] Acreage change due to reduction in planned unit acreage associated with SOGR.

[g] Acreage difference due to rounding.

Table 2-2. Comparison of alternatives by activity

Management Activity			Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Summary	Planned unit acreage including unit acres deferred or reserved from harvest		0	916	1,276	845	1,131
	Number of units		0	25	34	24	32
Timber Management	Management system	Two-aged (acres)	0	362	491	284	444
		Uneven-aged (acres)	0	79	79	98	79
	Harvest method	Clearcut with reserves (acres)	0	362	491	284	444
		Single tree selection (acres)	0	79	79	98	79
		Total of all methods (acres)	**0**	**441**	**570**	**382**	**523**
		Deferred or reserved from harvest (unit acres)	0	475	706	463	608
	Harvest system	Running skyline (acres)	0	272	356	179	297
		Small slackline (acres)	0	64	72	66	73
		Shovel (acres)	0	23	41	31	38
		Helicopter (acres)	0	82	101	105	115
		Yarding corridors through unsuitable land (slopes >72 percent) (acres)	0	0.6	0.8	0.6	0.9
Output	Potential harvest volume (mmbf)		0	15.1	20.2	12.4	18.3
Small Old-growth Reserves (Small OGRs)			2,458	3,913	3,935	3,942	3,942
Road Work	Construction	NFS road (miles)	0	3.1	4.7	3.9	4.3
		Temporary road (miles)	0	3.1	4.9	2.1	4.5
	Reconstruction (miles)		0	0	2.0	0	2.0

Table 2-2. Comparison of alternatives by activity

Management Activity			Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Economics	Total ccf		0	30,187	40,435	24,766	36, 656
	Total mbf		0	15,094	20,218	12,383	18,328
	Expected bid value ($/ ccf)		0	$20.50	$17.72	$8.67	$12.87
	Expected bid value total ($)		0	$618,747	$716,673	$214,642	$471,826
	Road cost / ccf		0	$25.53	$31.95	$31.22	$30.92
	Logging cost / ccf		0	$126.03	$131.73	$144.79	$135.28
Employment	Number of jobs	Sawmills	0	60	80	49	72
		Logging (includes road construction)	0	37	49	30	45
		Total Employment	**0**	**97**	**129**	**79**	**117**

Comparison of Alternatives by Significant Issue

Table 2-3 compares the responsiveness of each alternative to the significant issues developed during public involvement for the Tuxekan project.

Table 2-3. Responsiveness of alternatives to the issues

Issue 1 : Watershed Health and Karst System Protection
Ground disturbance due to timber harvest and road building would result in increased cumulative effects to soils, hydrology, and karst features and systems within Tuxekan project area watersheds.

Soils					
Measure	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
1SP1 Soil erosion: Slope evaluation using harvest acres on steep slopes (30-72%).	N/A	109	150	79	137
1SP2 Soil productivity: Total acreage of detrimentally disturbed soil.	N/A	38	54	30	49

Hydrology					
Measure	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
1H1 Percent increase in disturbed acres from harvesting, temporary and NFS roads within Riparian Management Areas (RMAs).	0	0.1	0.1	0.1	0.1
	With regard to cumulative effects to RMAs within the project area, only 0.1% of RMAs would be disturbed by timber harvest and road building activity by any of the action alternatives, as well as all future projects, proposed within the Tuxekan cumulative watershed effects area.				

Measure	**Watershed**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
1H2 Percent of watershed disturbance by proposed and past timber harvesting and roads proposed or built between1981 and 2011.	1	5	11	11	8	11
	2	11	12	12	12	12
	3	8	14	14	10	14
	4	5	6	6	6	6
	5	10	13	14	12	13
	6	0	0	4	3	4
	7	7	7	13	10	12
	8	3	3	3	3	3
	9	5	7	7	7	7
	10	10	12	12	12	12
	11	6	6	6	6	6
	12	11	13	14	12	13
	13	0	0	0	0	0
	14	10	10	10	10	10
	15	5	5	5	5	5
	16	8	8	8	8	8
	17	7	8	8	7	8
	18	3	10	10	10	10
	19	7	13	13	13	13
	20	9	9	9	9	9
	21	11	11	11	11	11
	All project area watersheds will be below the 20% threshold of concern for water yield in 2011 after implementation of the King Tux and Tuxekan Projects.					

Table 2-3. Responsiveness of alternatives to the issues

Issue 1 : Watershed Health and Karst System Protection
Ground disturbance due to timber harvest and road building would result in increased cumulative effects to soils, hydrology, and karst features and systems within Tuxekan project area watersheds.

Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1H3 Acres of wetlands disturbed out of 2,661 acres of wetlands present within the Tuxekan Project cumulative watershed effects area.	0	3.1	3.1	3.1	3.1
	In regards to cumulative effects to wetlands within the project area, only 3.1 of 2,661 project area wetland acres would be disturbed by timber harvest and road building activity by any of the action alternatives, as well as all future projects, proposed within the Tuxekan cumulative watershed effects area.				
1H4 Total number of all stream crossings	44	51	54	53	54
	Alternative 2 proposes 7 stream crossings while Alternatives 3 and 5 propose 10 and Alternative 4 proposes 9 stream crossings for the Tuxekan Project. This is at most a 20% increase in stream crossings for the project area.				

Karst

Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1K1 Acres of proposed single-tree selection (STS) on carbonate.	0	37	37	56	37
1K2 Acres of proposed clearcut with reserves (CCR) on carbonate.	0	319	447	255	401
1K3 Acres of harvesting proposed on carbonate..	0	356	484	311	438
1K4 Percent increase of harvest acres on carbonate less than 30 years old by 2012	0	18	27	16	22
1K5 Miles of proposed NFS road on high vulnerability karst	0	0	0	0	0
1K6 Miles of proposed temporary road on high vulnerability karst	0	0	0	0	0
1K7 Miles of proposed temporary and NFS road on carbonate	0	5.2	9.2	6.0	8.4
1K8 Cumulative total number of road miles on carbonate (existing, decommissioned, and proposed)	56.3	62.1	65.5	62.3	64.7
1K9 Percent increase in miles of road on carbonate	0.0	10.3	16.3	10.7	14.9

Table 2-3. Responsiveness of alternatives to the issues

Issue 2: Timber Sale and Local Economics
The proposed project may not provide jobs and income benefiting local residents or provide a positive economic return to the timber sale purchaser.

Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
2TSE1 Direct jobs potentially supported	0	97	129	79	117
2TSE2 Direct income supported ($)	$0	$3,568,496	$4,779,785	$2,927,555	$4,333,073
2TSE3 Expected bid value ($)	$0	$618,747	$716,673	$214,642	$471,826
	$0/ccf	$20.50/ccf	$17.72/ccf	$8.67/ccf	$12.87/ccf
	$0/mbf	$40.99/mbf	$35.45/mbf	$17.33/mbf	$25.74/mbf
2TSE4 Volume available for small sales (mmbf)	0	2.7	2.7	1.8	1.7

Table 2-3. Responsiveness of alternatives to the issues

Issue 3: Wildlife[a]

3a. The small old growth reserves as originally mapped do not meet Forest Plan minimum requirements. There is concern that because of past harvest on the island habitat connectivity between small old growth reserves would be further compromised.

Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
3aW1 Percent of the VCU in old-growth reserves					
VCU 556	10	19	19	20	20
VCU 557	8	16	16	16	16
VCU 560	11	19	17	19	19
VCU 587.2	20	17	21	17	17
3aW2 Percent of old-growth reserve that is productive old-growth.					
VCU 556	58	83	74	84	84
VCU 557	45	71	70	71	71
VCU 560	46	74	72	74	73
VCU 587.2	82	95	61	94	94
3aW3 Analysis of connectivity between reserves	The small OGRs would remain as currently mapped. Three of the four reserves do not currently meet Forest Plan minimum requirements or mapping criteria.	The boundaries of the four small OGRs in the project area would be adjusted according to the interagency committee's recommendations, but minor revisions of the interagency small OGRs in VCUs 557 and 587.2 would be made to accommodate harvest in two small areas.	The boundaries of the four small OGRs in the project area would be adjusted in limited ways to include additional old-growth stands and high-value deer winter range, and to meet Forest Plan acreage requirements	Fully implements the interagency committee's recommended boundary changes to all four small OGRs in the project area	Fully implements the interagency committee's recommended boundary changes to all four small OGRs in the project area

Table 2-3. Responsiveness of alternatives to the issues

Issue 3: Wildlife [a]					
3b. Proposed harvesting in the project area would reduce high-value deer habitat adversely impacting subsistence users.					
Measure	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
3bW1 Results of the deer model for WAA1531[b] (habitat capability, deer/sq. mile) [c] with predation.	1,437 deer; 26/mi^2	1,421 deer; 26/mi^2	1,415 deer; 25/mi^2	1,423 deer; 26/mi^2	1,417 deer; 25/mi^2
	Predicted habitat capability exceeds the minimum requirement of 17 deer per square mile (Forest Plan Clarification Papers 1998) and the recommendation of 18 deer per square mile (2000 Monitoring and Evaluation Report)				
3bW2 Acres of high value deer habitat available	8,717	8,302	8,177	8,360	8,224
	Of the action alternatives, Alternatives 2, 4 and 5 maintain the most winter habitat for deer, This is due to implementation of the interagency recommendations for small OGRs, increased amount of coarse-structured stands protected in small OGRs, and less harvesting of high-value habitat and volume class 6 and 7 stands, compared to Alternative 3. Both Alternatives 3 and 5 results in a 6% reduction of high value deer habitat available.				

[a] The cumulative effects analysis area for small OGRs and for connectivity is the four VCUs and Tuxekan Island (project area). Cumulative effects relative to time span for small OGRs are generally limited to the short-term (<10 years) and long term (>10 years).

The analysis area for direct, indirect, and cumulative effects on subsistence is Wildlife Analysis Area 1531 as this area encompasses the proposed project area. The time frame considered is until the end of the Plan rotation, approximately 2095, in order to evaluate the effects of the alternatives in concert with full Forest Plan implementation.

[b] Deer model results are calculated at the WAA scale, and not the smaller project scale.

[c] Habitat capability is defined as the long-term potential of an area to support animals rather than an estimate of actual numbers present

Comparison of Alternatives by Resource Effects

Table 2-4 displays a summary of resource effects by alternative. For a detailed discussion of the affected environment and direct/indirect and cumulative effects, see *Chapter 3* of this document.

Table 2-4. Summary comparison of effects by resource

Physical Environment
Soil Erosion
Direct/Indirect and Cumulative Effects Analysis Area: Direct/Indirect effects: planned harvested areas, including areas slated for temporary road construction; Cumulative effects: (1) within the proposed roads and harvest units, and (2) at the watershed scale - timeframe refers back to the 1920s, where timber harvest data is available. **Alternative 1 – No** impacts to soils. Soil recovery from past harvest continues. All action alternatives would meet Forest Plan standards for soil erosion. **Alternative 2 – Third** greatest impact to soils based on the amount of proposed timber harvest and road building. Moderate risk for soil erosion exists from log yarding and temporary road construction. Risk for surface erosion would be the primary impact although no harvest would occur on > 72% slopes with contiguous acreage > 1 acre and no temporary road building would occur on slopes > 67%. Slopes are low to moderately stable with the absence of glacial till on steep slopes. McGilvery soils would be impacted though bench type topography and micro-relief would lower risk of exacerbated surface erosion from log yarding. **Alternative 3 – Greatest** potential impact to soils. Surface erosion is the greatest risk for soil loss with highest amount of harvest and road building activities. This alternative has no harvest on slopes > 72% on areas greater than one acre and no road building on slopes > 67%. This alternative has the greatest potential impact to McGilvery soils though the topography lowers risk. **Alternative 4 – Lowest** risk to soils of the action alternatives. Surface erosion is reduced since roughly half of steeper erosion prone slope is proposed for harvest than alternative 3. No harvest is planned on McGilvery soils. As with all the action alternatives, no harvest would occur on > 72% slopes greater than 1 acre and no road building on slopes > 67%. **Alternative 5 –** Alternative 5 is similar in impact to Alternative 3 except temporary road locations are moved to more stable ground and harvest on steep slopes is reduced. This alternative has improved project design features that lower impact to soils compared to Alternative 3, though the amount of planned harvest proposed has greater risk for surface erosion than Alternatives 2 and 4. **Cumulative Effects** - When considering cumulative effects within proposed harvest areas, long term impacts from the combined past, present and reasonably foreseeable future actions were not evident since <u>soil quality standards would be met for all alternatives</u> and planned harvest areas have minimal past disturbance. The cumulative impact of erosion from naturally occurring windthrow and harvest activities likely follows closely with predicted direct/indirect effect.

Table 2-4. Summary comparison of effects by resource

Soil productivity
Direct/Indirect and Cumulative Effects Analysis Area: Direct/Indirect effects: planned harvested areas, including areas slated for temporary road construction; Cumulative effects: (1) within the proposed roads and harvest units, and (2) at the watershed scale - timeframe refers back to the 1920s, where timber harvest data is available. **Alternative 1 –** No impacts to soils. Soil recovery from past harvest continues. All action alternatives would meet Forest Plan standards for soil productivity. **Alternative 2 –**Alt 2 has the <u>second lowest</u> potential impact to soils of the action alternatives due to limited amount of road building and planned harvest. **Alternative 3 –** <u>Greatest</u> potential impact to soils with maximum amount detrimental soil disturbance from timber harvest and road building. **Alternative 4 –** <u>Lowest</u> potential impact to soils of the action alternatives. Three of the higher risk units are excluded. **Alternative 5 –**<u>Second</u> greatest risk to soil productivity. This alternative lowers risk below alternative 3 with improved proposed road locations, lowering clearcut harvest by 47 acres and switching to full suspension helicopter yarding in units 560-411 and the SW portion of 560-412. **Cumulative Effects** – Based on Cumulative watershed soil disturbance from past and present harvesting and road building, <u>all alternatives would meet the Region 10 Soil Quality Standards</u>. All alternatives would have past and planned activities below the 15 percent threshold and therefore would comply with the Tongass NF plan for the soils resource. Ranked from greatest to least impact: Alternative 3, Alternative 5, Alternative 2, and Alternative 4.
Water Yield
Direct/Indirect Effects Area Analyzed: Within all proposed timber harvest units and all areas proposed for road building or reconstruction. Cumulative Effects Analysis Area: The 17,730 acre Tuxekan Project Area and the 21 individual coastal or karst defined watersheds. **Alternative 1 –** No localized impacts to water yield. Cumulative effects: Regrowth in previously harvested areas will occur in project area watersheds; moving vegetation and, subsequently, water yield closer to pre-harvest conditions. At the beginning of project implementation,4 of the 21 project area watersheds would be above the 20% threshold of concern for water yield. All project area watersheds would be below the threshold of concern of 20% in 2012-the scheduled ending to the project. **Alternative 2 -** A total of 463 acres of disturbance from timber harvest and road building will occur. Total disturbance from existing condition will increase by 2.6%. Watersheds expected to see localized water yield increases from implementation include: 1, 3, 5, 9, 10, 12, 18, and 19. Cumulative effects: After project implementation is final in 2012, none of the 21 project area watersheds will be above the 20% threshold of concern for water yield. **Alternative 3 -** A total of 606 acres of disturbance from timber harvest and road building would occur. Total disturbance from existing condition will increase by 3.4%. Watersheds expected to see localized water yield increases from implementation include: 1, 3, 5, 6, 7, 9, 10, 12, 18, and 19. Cumulative effects: After project implementation is final in 2012, none of the 21 project area watersheds will be above the 20% threshold of concern for water yield. **Alternative 4 -** A total of 403 acres of disturbance from timber harvest and road building will occur. Total disturbance from existing condition will increase by 2.3%. Watersheds expected to see localized water yield increases from implementation include: 1, 3, 5, 6, 7, 9, 10, 18, and 19. Cumulative effects: After project implementation is final in 2012, none of the 21 project area watersheds will be above the 20% threshold of concern for water yield **Alternative 5 -** A total of 555 acres of disturbance from timber harvest and road building will occur. Total disturbance from existing condition will increase by 3.1%. Watersheds expected to see localized water yield increases from implementation include: 1, 3, 5, 6, 7, 9, 10, 12, 18, and 19. **Cumulative effects:** After project implementation, <u>none of the 21 project area watersheds will be above the 20% threshold of concern for water yield.</u>

Table 2-4. Summary comparison of effects by resource

<table>
<tr><td colspan="6">Riparian and Stream Channel</td></tr>
<tr><td colspan="6">Direct/Indirect Effects Area Analyzed: Within all proposed timber harvest units and stream channels downstream of proposed timber harvest units. Cumulative Effects Analysis Area: The 17,730 acre Tuxekan Project Area.
Alternative 1 - No direct/indirect or cumulative effects to riparian areas/stream channels as this is the no action alternative.
All Action Alternatives: No timber harvest to occur within RMAs as per 1997 Forest Plan Standards and Guidelines. Approximately 0.1% of the total RMA would be disturbed with road building activity.
Cumulative effects: Total RMA disturbance would be increased from 22.5% to 22.6%. .</td></tr>
<tr><td rowspan="2">Road Construction in RMAs (miles)</td><td>Alternative 1</td><td>Alternative 2</td><td>Alternative 3</td><td>Alternative 4</td><td>Alternative 5</td></tr>
<tr><td>0.0</td><td>1.0</td><td>1.3</td><td>1.0</td><td>0.9</td></tr>
<tr><td colspan="6">Wetlands</td></tr>
<tr><td colspan="6">Direct/Indirect Effects Area Analyzed: Within all proposed timber harvest units and all areas proposed for road building or reconstruction. Cumulative Effects Analysis Area: The 17,730 acre Tuxekan Project Area.
Alternative 1 - No direct/indirect or cumulative effects to wetlands as this is the no action alternative.
Alternatives 2, 3, 4, and 5 - Approximately 180 feet of temporary road accessing unit 557-404 will cross Forested Wetland/Emergent Sedge Wetland Complex (FES). Approximately 2.8 acres of wetland type FES and 0.3 acres of wetland type FW have the potential to be impacted by timber harvest activity. Disturbance may include: compaction of hydric soils, removal of vegetation, and altering of wetland hydrology. No wetlands would be filled.
Cumulative effects: Disturbance by timber harvest of 0.1% of cumulative effects area wetlands. Implementation of BMP 12.5 will protect overall wetland function, integrity, and value within the project area.</td></tr>
</table>

Table 2-4. Summary comparison of effects by resource

Sediment Yield
Direct/Indirect Effects Area Analyzed: All proposed timber harvest units and areas proposed for road building or reconstruction. Cumulative Effects Analysis Area: The 17,730 acre Tuxekan Project Area and the 21 individual coastal or karst defined watersheds. **Alternative 1 -** No direct/indirect or cumulative effects to sediment yield as this is the no action alternative. **Alternatives 2, 3, 4, and 5 -** A slight increase in sediment yield is anticipated for all alternatives. Impacts to sediment yield will be localized and negligible. The majority of roads to be built will be on slopes less than 30%. No roads will be built on slopes over 67%. Mass wasting events from road building are not expected due to thin soils over bedrock. Less than 0.1% of the project area RMAs will be disturbed by road building no matter which action alternative is selected. No timber harvest will occur within RMAs. Additional stream crossings would be: seven stream crossings for Alternative 2, nine for Alternative 4, and ten for Alternatives 3 and 5. Alternatives 2 would produce approximately 11.2 tons of sediment to project area rivers and streams annually via these stream crossings, Alternative 4 14.4 tons, and Alternatives 3 and 5 16.0 tons. Approximately four acres of timber harvest will occur on slopes greater than 72% under Alternatives 2 and 4; six acres for Alternative 3 and 5. The topography of the Tuxekan project area is not prone to mass erosion (i.e. soil creep, soil slumps, landslides, mudflows, debris flows, debris avalanches and torrents, rockfalls, and snow avalanches) since soils are thin on steep slopes. Surface erosion by water is the primary erosion process on Tuxekan Island due to intense rainfall. Field visits found Units 560-412 and 587.2-414 to have surface erosion concerns (see Unit cards, Appendix B) in reserve portions of the unit. Similarly, surface erosion may not be as critical since many of the > 72 percent slope areas are bedrock. Alternative 5 has the least risk of all of the action alternatives for surface erosion based on the combination of clearcutting with reserves and cable logging systems.Increases to sediment yield from increases to water yield are not anticipated. **Cumulative effects:** The King Tux Pre-Commercial Thinning Project and the Tuxekan Project (Alternatives 2, 3, 4, and 5), when added to existing condition, will increase sediment yield slightly. The majority of sediment yield increase from these projects will be from stream crossings. Currently, 4 of the 21 project area watersheds are above the threshold of concern for water yield. It is likely that past activity has already impacted the sediment yield of the project area. The addition of both the King Tux Pre Commercial Thinning Project and the Tuxekan Project (Alternatives 2, 3, 4, and 5) will keep water yield static, neither improving nor reducing current sediment yield effects.
Karst Water Quantity, Quality and Sediment Yield
Direct/Indirect and Cumulative Effects Area Analyzed: DirectiIndirect effects: all proposed timber harvest units and all areas proposed for road building or reconstruction. Cumulative Effects: The 17,730 acre Tuxekan Project Area from 1983-2012 (hydrologic recovery period) **Alternative 1 -** No additional changes to existing water quantity, quality conditions and to existing sediment loads. **Alternatives 2, 3, 4, and 5** - Alternatives 3, 5, 2, and 4 would increase harvest during the hydrologic recovery period on carbonate rocks by 18, 27, 16, and 22% respectively. Based on the use of BMPs and Forest Plan Standards and Guidelines, no direct/indirect effects will exceed those expected in the Forest Plan. Of the activities affecting water quantity, quality and sediment load on carbonate rock, Alternative 3 proposes the most ground disturbance based on: clear cut acres with reserve on carbonate rock (447) and road construction (9.6). Alternative 4 proposes the least ground disturbance based on harvesting on carbonate rock (311). Alternative 2 proposes the least road construction on carbonate rock (5.8). Both short and long term effects would be prevented or reduced based on implementation of standards and guidelines and BMPs. Short term sediment increases would occur under all action alternatives during culvert installation and road construction. Increases in short-term potential sediment sources will likely result in short-term impacts to sediment related water quality analytes. Long-term additions to sediment yield would be associated with the roads for the duration of their existence. **Cumulative effects:** While Alternatives 2-5 have the potential for increased short-term sediment yields, implementation of BMPs are expected to maintain cave and karst resources comparable to the existing condition.

Table 2-4. Summary comparison of effects by resource

Transportation and Logging Systems
Direct/Indirect and Cumulative Effects Analysis Area: the project area boundary. **Alternative 1 –** The transportation system would not be directly or indirectly affected by this alternative. No new roads would be constructed under this alternative during this planning cycle, so no changes would be made to the current transportation system. **Alternatives 2, 3, 4, and 5 –** All of the action alternatives propose new NFS and temporary road construction. Alternative 2 proposes construction of 3.1 miles of new NFS road and approximately 3.1 miles of temporary road. Alternative 3 proposes construction of 4.7 miles of new NFS road, approximately 4.9 miles of temporary road, and approximately 2 miles of reconstruction. Alternative 4 proposes construction of 3.9 miles of new NFS road and approximately 2.1 miles of temporary road. Alternative 5 proposes construction of 4.3 miles of new NFS road, approximately 4.5 miles of temporary road, and approximately 2 miles of reconstruction. All action alternatives propose to decommission new temporary roads and to put all new NFS roads into storage. **Cumulative Effects** - By closing existing roads that are currently not drivable, few or no impacts are expected regarding access to recreation and subsistence resources due to the lack of motorized use of these roads. Actions on non-NFS lands within the Tuxekan project area are not expected to impact the road system or access to places within the project area. Following harvest activities, open road density for the Tuxekan project area (including non-NFS lands) would change from the existing 1.4 miles per square mile to 0.8 mile per square mile. The current trend is to reduce the mileage of open roads to match available maintenance funds and the needs for protection of other resources.

Table 2-4. Summary comparison of effects by resource

Biological Environment
Vegetation Management
Direct/Indirect and Cumulative Effects Analysis Area: Direct and indirect effects are described for the proposed units themselves, and for the suitable timberlands in the analysis area (NFS lands on the island). The maximum acreage assessed at the unit scale is the total acreage in Alternative 3 (570 acres). The suitable timber land on the island totals 9,697 acres. **Alternative 1 –** There are neither positive nor negative effects associated with this alternative in the short term. However, this alternative does not satisfy the need for the project of implementing Forest Plan goals and objectives in the project area, which seek to provide a supply of timber from the Tongass which meets the annual and planning-cycle market demand. Long term effects resulting from the No Action alternative include the following. No acres are regenerated. No new age class is established. No stands are managed for increased production, and no stands have improved forest health conditions such as reduced dwarf mistletoe and reduced stem decay. **Alternative 2 -** Alternative 2 applies the CCR prescription on 362 acres of suitable timber land, moving those acres quickly toward the desired condition of healthy, productive commercially valuable forest. Alternative 2 applies STS on 79 acres, which adds value to the project, while maintaining high forest cover on the site. Alternative 2 meets the project objectives but does not maximize the output. **Alternative 3 -** Alternative 3 applies the CCR prescription on 491 acres of suitable timber land, moving those acres quickly toward the desired condition of healthy, productive commercially valuable forest. Alternative 3 applies STS on 79 acres, which adds value to the project, while maintaining high forest cover on the site. Alternative 3 best meets the project objectives. **Alternative 4 -** Alternative 4 applies the CCR prescription on 284 acres of suitable timber land, moving those acres quickly toward the desired condition of healthy, productive commercially valuable forest. Alternative 4 applies STS on 98 acres, which adds value to the project, while maintaining high forest cover on the site. Alternative 4 meets the project objectives, but does not maximize the output. **Alternative 5 -** Alternative 5 applies the CCR prescription on 444 acres of suitable timber land, moving those acres quickly toward the desired condition of healthy, productive commercially valuable forest. Alternative 5 applies the STS prescription on 79 acres, which adds value to the project, while maintaining high forest cover on the site. Alternative 5 meets the project objectives, but does not maximize the output. **Cumulative Effects** - Cumulative effects includes timber activities that took place on the National Forest System lands on the island beginning in the 1920s, through on-going activities (thinning), and foreseeable future actions affecting forest stands. National Forest System lands on Tuxekan Island total about 16,890 acres. All action alternatives create the same cumulative positive effects. They only differ in the number of acres harvested and regenerated to new, young stands. Alternative 2 adds 362 acres of new age class stands; Alternative 3, 491 acres; Alternative 4, 284 acres; and Alternative 5, 444 acres.
Botany – Sensitive Plant Species
Direct/Indirect and Cumulative Effects Analysis Area: Tuxekan Island **Alternative 1 –**No direct, indirect effects are expected to sensitive species. **Alternatives 2, 3, 4 and 5 -** Due to the fact that no sensitive species are known within the project area and no species were found during surveys, and Forest Plan mitigation measures provide for protection of most unknown populations, project activities proposed in all alternatives may impact individuals but are not likely to result in a loss of viability in the planning area or cause a trend toward federal listing. **Cumulative Effects** - Because no direct, indirect effects are expected to sensitive species, no cumulative effects are expected.

Table 2-4. Summary comparison of effects by resource

Wildlife - Old Growth Reserves and Connectivity
Direct/Indirect and Cumulative Effects Analysis Area: The analysis areas for direct, indirect and cumulative effects on OGRs are VCUs. For connectivity, the analysis area for direct, indirect effects is only the NFS land on Tuxekan Island, while all lands on Tuxekan Island (regardless of ownership) was used for cumulative effects. **Alternative 1 –** Existing OGRs would continue to not meet Forest Plan direction. No harvest would occur and there would be no change other than that which would occur naturally in old growth habitats or connectivity. **Alternative 2 –** Interagency OGR would be incorporated with minor modifications. Connectivity is maintained by deferring harvest in several units in existing wildlife corridors. **Alternative 3 –** Existing OGRs would be adjusted to meet Forest Plan direction (for acres and POG) but would provide less suitable OGRs due to size and shape. No units are dropped to maintain connectivity. This alternative would have the most impact on connectivity, including the north-south corridor in the center of the island. **Alternative 4 –** Interagency OGRs would be incorporated and connectivity would be maintained by deferring of a few units, as well as increased use of single tree selection harvest. **Alternative 5 –** Interagency OGRs would be incorporated. Connectivity is maintained, including through the center of the island by deferring one unit and use of STS harvest. **Cumulative Effects** - The effects of past timber harvesting were incorporated into the development of the Interagency small OGR recommendation. In addition, the past harvesting was considered during the connectivity analysis (see Direct and Indirect Effects analysis above). The only foreseeable future action is timber management in previously harvested stands (pre-commercial thinning). Pre-commercial thinning could improve connectivity between stands and across the island over the long-term, but effects would not vary by alternative.
Wildlife - Management Indicator Species
Direct/Indirect and Cumulative Effects Analysis Area: The analysis areas for direct and indirect effects for most species are the NFS lands on Tuxekan Island. For cumulative effects, all lands on Tuxekan Island (regardless of ownership) was used. For Sitka black-tailed deer and wolf the analysis area for direct and indirect effects & cumulative effects used WAA 1531. **Alternative 1 –** No harvest would occur and there would be no change other than that which would occur naturally in old growth habitats or connectivity between them. **Alternative 2 –** This alternative generally ranked second best of the action alternatives. This was based on deferred harvest of some units and retention of more old growth habitat, as well as lower open road densities during project activities. This alternative would contribute to Forest Plan goal of maintaining viable populations. **Alternative 3 –** This alternative consistently ranked lowest of the action alternatives for maintaining habitat for species. This is based on higher levels of harvest, increased use of clearcut with reserves harvest prescriptions and higher open road densities during project activities. . This alternative would contribute to Forest Plan goal of maintaining viable populations. **Alternative 4 –** This alternative consistently ranked the highest of the action alternative for maintaining habitat. This is true for all species when addressing cumulative effects. This is based on lower levels of harvest, increased emphasis on single tree selection harvest prescription, as well as lower open road densities during project activities. . This alternative would contribute to Forest Plan goal of maintaining viable populations. **Alternative 5 –** This alternative generally ranked between Alternatives 2 and 3 for most species. This based on levels of harvest, type of harvest prescriptions used and open road densities during project activities. . This alternative would contribute to Forest Plan goal of maintaining viable populations. **Cumulative Effects** – Varies by species due to harvest prescriptions and level of harvest within the WAA, but Alternative 4 ranks the highest for maintaining habitat.

Table 2-4. Summary comparison of effects by resource

Wildlife - Threatened, endangered, sensitive species
Direct/Indirect and Cumulative Effects Analysis Area: The analysis areas for direct and indirect effects for most species are the NFS lands on Tuxekan Island and saltwater in the vicinity of the MAF. **Alternative 1 –** No harvest would occur and there would be no change other than that which would occur naturally in old growth habitats or connectivity between them. **Alternative 2 –** There would be no effect to Steller sea lions and implementation of this alternative may affect individual humpback whales or habitat, but is not likely to adversely affect population viability. Implementation of this alternative may impact analyzed sensitive species, but will not likely result in a loss of viability in the Planning area, nor cause a trend toward federal listing. **Alternative 3 –** There would be no effect to Steller sea lions and implementation of this alternative may affect individual humpback whales or habitat, but is not likely to adversely affect population viability. Implementation of this alternative may impact analyzed sensitive species, but will not likely result in a loss of viability in the Planning area, nor cause a trend toward federal listing. **Alternative 4 –** There would be no effect to Steller sea lions and implementation of this alternative may affect individual humpback whales or habitat, but is not likely to adversely affect population viability. Implementation of this alternative may impact analyzed sensitive species, but will not likely result in a loss of viability in the Planning area, nor cause a trend toward federal listing. **Alternative 5 –** There would be no effect to Steller sea lions and implementation of this alternative may affect individual humpback whales or habitat, but is not likely to adversely affect population viability. Implementation of this alternative may impact analyzed sensitive species, but will not likely result in a loss of viability in the Planning area, nor cause a trend toward federal listing. **Cumulative Effects** – No cumulative effects due to the limited potential for indirect effects to humpback whale habitat.
Subsistence
Direct/Indirect and Cumulative Effects Analysis Area: The analysis area for direct, indirect, and cumulative effects is Wildlife Analysis Area 1531 as this area encompasses the proposed project area. The time frame considered is until the end of the Plan rotation, approximately 2095, in order to evaluate the effects of the alternatives in concert with full Forest Plan implementation. **Alternative 1 –** No Action Alternative, do not present a significant possibility of a significant restriction to subsistence uses of black bear, furbearers, marine mammals, waterfowl, salmon, other finfish, shellfish, timber resources, and other foods such as berries and roots. However, the cumulative effects of past timber harvest, together with the potential to experience a deep snow winter may represent a significant possibility of a significant restriction of subsistence use of deer. **Alternatives 2, 3, 4, 5 -** There is little likelihood that subsistence use in the Tuxekan project area would be substantially affected by any of the action alternatives. The cumulative effects of past and future timber harvests (and associated activities), along with those of the proposed project, combined with the potential to experience a deep snow winter may represent a significant possibility of a significant restriction of subsistence use of deer. With regard to other subsistence resources, the potential foreseeable effects from the action alternatives in the Tuxekan project area do not indicate a significant possibility of a significant restriction of subsistence uses for black bear, furbearers, marine mammals, waterfowl, salmon, other finfish, shellfish, timber resources, and other foods such as berries and roots. **Cumulative Effects** - Following an analysis of the individual effects of the ANILCA categories, there is little likelihood that subsistence use in the Tuxekan project area would be substantially affected by any of the action alternatives. However, as previously disclosed, the cumulative effects of past and future timber harvests (and associated activities), along with those of the proposed project, together with the potential to experience a deep snow winter may represent a significant possibility of a significant restriction of subsistence use of deer. With regard to other subsistence resources, the potential foreseeable effects from the action alternatives in the Tuxekan project area do not indicate a significant possibility of a significant restriction of subsistence uses for black bear, furbearers, marine mammals, waterfowl, salmon, other finfish, shellfish, timber resources, and other foods such as berries and roots.

Table 2-4. Summary comparison of effects by resource

Fish Species and Habitat
Direct/Indirect and Cumulative Effects Analysis Area: The 17,730 acre Tuxekan Project Area and the 21 individual coastal or karst defined watersheds. **Alternative 1 –** Watersheds would continue to recover as stated above under the Hydrology discussion. Sediment delivery to streams would persist in the short and long term as a result of existing roads within RMAs and stream crossings (see Karst and Sediment Yield above). Cumulative effects on Essential Fish Habitat (EFH) and MIS species and habitat would stay the same or improve over time with recovery of vegetation and further road maintenance. **Alternative 2, 3, 4, 5** - Alternative 3 proposes timber harvesting on the greatest number of acres (570 total) and proposes to construct the greatest amount of new road (4.7 miles new construction and 4.9 miles of temporary). Alternative 4 would harvest the fewest acres (382 total) and least amount of road construction (3.9 miles new construction and 2.1 miles of temporary). Alternatives 2 and 5 fall between the other action alternatives. Alternative 2 proposes harvesting 441 acres and construction of 3.1 miles of new road and 3.1 miles of temporary road. Alternative 5 proposes timber harvesting on 523 acres, construction of 4.3 miles of new road and 4.5 miles of temporary roads. There would be seven stream crossing for Alternative 2, nine for Alternative 2, and ten for Alternatives 3 and 5. Construction of a bridge or arched culvert over a Class I stream in Watershed 18 would occur under all action alternatives. In addition, an additional bridge or arched culvert would be constructed under Alternatives 3 and 5 for reconstruction of road 1470500. Five Class IV culverts are proposed under Alternatives 2, 3, and 5; and 3 Class IV culverts are proposed under Alternative 4. Fine sediment generated from project activities associated with the action alternatives could negatively impact sensitive spawning habitat. However, stream buffers, application of wind firm buffers on specific units, avoidance of steep/unstable slopes, and road construction and stream crossing mitigation measures would be expected to minimize negative direct and indirect effects to a point where impacts to spawning gravel and salmonid production would not be detectable relative to the existing background conditions. **Cumulative Effects** - By implementing Forest Plan Standards and Guidelines, BMPs, and utilizing other design and mitigation measures discussed above; direct, indirect, and cumulative effects of the proposed activities on MIS species and habitat would be minimized. The proposed action alternatives would meet Forest Plan fisheries and riparian standard and guidelines, requirements under the Endangered Species Act, Recreational Fisheries and the Coastal Zone Management Act. All the Action Alternatives in Tuxekan Project may adversely affect EFH as a result of vegetation management activities and associated temporary road building. However, by implementing Forest Plan Standards and Guidelines and BMP's, direct, indirect, and cumulative effects of the proposed activities on EFH will be minimized.
Socioeconomic Environment
Heritage
Direct/Indirect and Cumulative Effects Analysis Area: Tuxekan Island **Alternatives 1 through 5 -** There would be no adverse effect to heritage resources from project activities. **Direct/Indirect and Cumulative Effects** – Direct /indirect and cumulative effects are considered negligible.
Scenery
Direct/Indirect and Cumulative Effects Analysis Area: Priority travel routes and use areas: Small Boat Route: Tuxekan Pass to Edna Bay; Saltwater Use Area: a portion of the West Coast Waterway – El Capitan Pass to Tenass Pass to Karheen Pass, Dispersed Recreation Areas: Staney Creek (from recreation site to mouth), Mouth of Staney Creek and the cove to the south; Communities: Naukati; Forest Service Recreation Cabin: Staney Creek Cabin including the estuary **Alternative 1 –** There would be no effects to scenery. **Alternative 2, 3, 4 and 5 –** The amount of proposed harvest is 5% of the viewshed, well within the 50% total visual disturbance cumulative effects requirement per viewshed and all meet Maximum VQO thresholds. **Cumulative Effects** - All the action alternatives meet the 50 percent total visual disturbance cumulative effects requirement per viewshed established in the Forest Plan, and the Maximum Modification VQO.

Table 2-4. Summary comparison of effects by resource

Recreation

Direct/Indirect and Cumulative Effects Analysis Area: Tuxekan Island over a 30-year time period from 1982 to 2012. The timeframe for effects to the hunter user group (displacement) extends for 150 years from the start of harvesting due to the length of time associated with the stem exclusion stage for young forests.

Alternative 1 – No effects are expected to occur. No change to ROS.

Alternative 2, 3 4 and 5 - Effects to the ROS factors vary only slightly between all the action alternatives. Some short-term increases in motorized access and social encounters may occur during the timber harvesting period.

Cumulative Effects - Once the proposed access plan is implemented, there will be less long-term motorized access, and the area would return into a more natural setting. These effects are consistent with the Roaded Modified and Semi-primitive Motorized ROS classes for Tuxekan Island.

Socioeconomic Community

Direct/Indirect/ Effects Area Analyzed: Tuxekan Island

Cumulative Effects Analysis Area: Various scales from local (Tuxekan Island and Forest-wide) to regional context (Southeast Alaska) for the past, present, and reasonably foreseeable future through 2009.

Measurement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Direct Jobs	0	97	129	79	117
Direct Income	$0	$3,568,496	$4,779,795	$2,927,555	$4,333,073
Expected Bid Value	$0	$618,747	$716,673	$214,642	$471,826
Volume available for small sales	0.0 mmbf	2.7 mmbf	2.7 mmbf	1.8 mmbf	1.7 mmbf

Cumulative effects - Cumulative effects to jobs and income resulting from implementation of Alternatives 2, 3, 4, or 5 would be a contribution of approximately 15.1, 20.2, 12.4, and 18.3 MMBF of timber sale offerings respectively. Estimates of planned offerings from all ownerships from 2006 through 2009 as displayed under Cumulative Effects for Issue 2, Timber Sale and Local Economics, include estimated contributions from the Tuxekan Project. These planned timber sale volumes would be expected to maintain an adequate supply of timber to support the local wood products industry in the near term. However, much of the economic distress experienced in rural Southeast Alaska is endemic and not likely to improve as a result of the Tuxekan project.

Chapter 3 - Affected Environment, Environmental Consequences, and Cumulative Effects

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Chapter 3 – Affected Environment and Environmental Consequences

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Chapter 3 - Affected Environment, Environmental Consequences, and Cumulative Effects

Introduction

Chapter 3 displays the current condition of the resources within the project area and the analysis of direct, indirect, and cumulative effects of alternatives for the Tuxekan Island Timber Sale Project. It also presents the scientific and analytical basis for comparison of alternatives presented in the Chapter 2 above.

Forest Plan References to Cumulative Effects

This environmental impact statement is tiered to the Forest Plan Final Environmental Impact Statement (FEIS) (USDA FS 1997b) in which some of the cumulative effects has been previously discussed.

General Cumulative Effects

Cumulative effects consider the impacts of proposed projects on a landscape scale across time and space. Cumulative effects analysis examines the effects of other activities on National Forest System (NFS) and non-NFS land that may occur across the landscape but may not be readily apparent at a smaller scale. Cumulative effects will be analyzed under each resource area, and the reason for choosing specific cumulative effects criteria will be explained in the individual cumulative effects analyses.

Issue 1 - Watershed Health and Karst System Protection

Ground disturbance due to timber harvest and road building will result in increased cumulative effects to soils, hydrology, and karst features and systems within Tuxekan Project Area watersheds.

Table 3-1. Issue 1: Soils Measures

Measurement Number	Measurement
1SP1	Compliance with R10 Soil Quality Standards (USDA FS 1992).
1SP2	Soil productivity: Total acreage of detrimentally disturbed soil.

Table 3-2. Issue 1: Hydrology measures

Measurement Number	Measurement
1H1	Percent (%) increase in disturbed acres from harvesting, temporary and NFS roads within Riparian Management Areas (RMAs).
1H2	Percent watershed disturbance by proposed and past timber harvesting and roads proposed or built between 1981 and 2011.
1H3	Acres of wetlands disturbed out of 2,661 acres of wetlands within the Tuxekan Project cumulative watershed effects area.
1H4	Total number of all stream crossings.

Table 3-3. Issue 1: Karst measures[a]

Measurement Number	Measurement
1K1	Acres of harvest proposed.
1K2	Acres of proposed timber harvest on carbonate.
1K3	Acres of proposed single tree selection (STS) on carbonate.
1K4	Acres of proposed clearcuts with reserves (CCR) on carbonate.
1K5	Percent increase of harvest/thinning acres on carbonate less than 30 years old by 2012.
1K6	Miles of proposed NFS road on high vulnerability karst
1K7	Miles of proposed temporary road on high vulnerability karst.
1K8	Miles of proposed temporary and NFS road on carbonate.
1K9	Cumulative total number of road miles on carbonate (existing, decommissioned, and proposed).

[a]Units of measure refer to “carbonate” rock. Low, moderate, and high vulnerability karst are all included on the term “carbonate”.

Soils

Table 3-4 summarizes the analysis of results used to compare effects to soils for Issue 1. Additional information regarding the soils analysis is provided below. For the complete soils analysis, please refer to the specialist’s report for soils located in the planning record.

Table 3-4. Comparison of issue 1 soils measures by alternative

Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1SP1 Soil erosion: Slope evaluation using harvest acres on steep slopes (30-72%).	N/A	109	150	79	137
1SP2 Soil productivity: Total acreage of detrimentally disturbed soil.	N/A	38	54	30	49

General Affected Environment

Scope of Analysis

For direct and indirect effects the analysis area is limited to the proposed roads and harvest units. For cumulative effects the analysis is conducted at two scales: (1) within the proposed roads and harvest units, and (2) at the watershed scale. The timeframe refers back to the 1920s, where timber harvest data is available. The analysis area concentrates on proposed harvested areas, including areas slated for temporary road construction. Proposed harvested areas are defined as the activity area. System roads, log landings and log transfer facilities are not analyzed because these are considered dedicated purposes and excluded from the productive land base.

Affected Area

The geology and geomorphology of Tuxekan Island has a strong influence on soil development. Recent glaciation over the base of carbonate rock has left mostly low rounded hills with short steep areas on the lee side of the ice advance. The highest elevation within the project area is 1100 feet. Glacial till is sparse and mainly confined to lower elevations. Soil depth ranges from more than 40 inches to less than 10 inches. Areas of rock outcrop are common at higher elevations and on the steeper slopes. Surface soil erosion is minimal due the thick duff layer covering most soils and the well drained nature of the soils.

Soil mass wasting is relatively rare due to thin well drained soils, on steeper slopes. During project reconnaissance only two small cutbank failures were found. Both were associated with road construction on steeper slopes. Hillslopes underlain by carbonate bedrock in the proposed harvest units are typically “broken” slopes, having relatively small benches perpendicular to the hillslope. These benches increase hillslope stability by creating slope breaks that in turn decrease the overall slope angle.

Soil development on Tuxekan Island and elsewhere in Southeast Alaska is heavily influenced by the temperate maritime climate. Heavy rainfall and cool air provide an environment where organic matter decomposes slowly and builds up in layers ranging in thickness from a few inches to tens of feet in muskegs.

The analysis area encompasses a range of soils typically found on carbonate rock in Southeast Alaska. In general, soils are underlain by karst, which provides good soil drainage. Poorly drained organic soils have formed over areas of dense till due to poor drainage. These soils usually develop on glacial till and often support forested wetlands and muskegs. Glacial till soils, primarily the Kina Maybeso Association in the Tuxekan project, make up a small portion of Tuxekan Island and typically are found below 350 feet elevation (see Table 3-5). Figure 3-1 shows the relatively small distribution of these deeper organic, more poorly drained soils in the activity area.

Table 3-5. Soil map units and taxonomy for predominant soils that occur within the proposed treatment units.

Map Unit	Taxonomy	Acres
Sarkar-McGilvery Complex	A complex of Well drained mineral and organic soils less than 20 inches thick over limestone bedrock.	92
Ulloa-Sarkar Complex	A complex of deep (>40 inches thick) and shallow (less than 20 inches thick) well drained mineral soils over limestone bedrock.	478
Kina-Maybeso Association	Deep and moderately deep organic soils over dense glacial till.	6

Soil productivity on Tuxekan Island is influenced by the degree of soil saturation, the soil depth, and the stage of succession. The Ulloa and Sarkar soil series are different from other Southeast Alaska soils in that the underlying karst topography ensures good soil drainage drainage (Table 3-5). This well-drained feature and base cations from the limestone rock enhance the productive capacity of these soils by allowing aeration and higher soil pH, whereas other soils in Southeast Alaska are limited by the excess moisture and acid conditions. The Soil Specialist Report provides a more detailed description of the project area and the soil productivity cause and effect relationships.

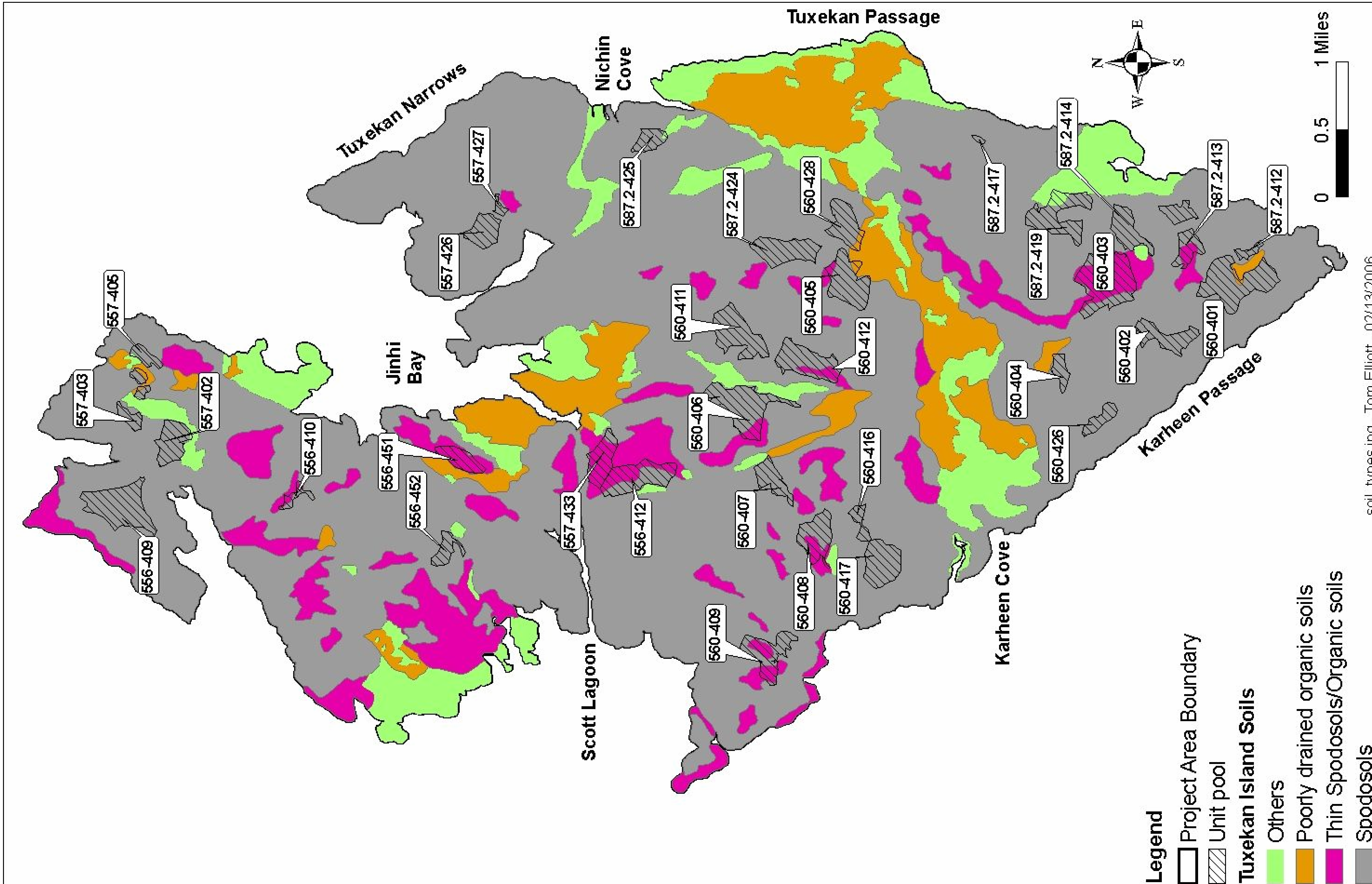

Figure 3-1. Soil types of Tuxekan Island

Windthrow of large groups of trees is the dominant natural disturbance process on Tuxekan Island. Timber harvesting and road building in addition to windthrow and debris avalanches may result in surface erosion. Bare roads and rock pits are the primary sources from management activities. Surface erosion occurs to a lesser extent from windthrow due to micro-topographic features that trap sediment.

Soil Direct / Indirect Effects Specific to Alternative 1

Alternative 1 would meet Forest Plan standards for soil productivity since no new harvest and road-building activities would be proposed. Natural erosion and transport processes, including surface erosion, and stream erosion would continue.

Effects common to all action alternatives

Implementation of Forest Plan Standards and Guidelines limit effects to soils from activities proposed in all action alternatives are within those analyzed in the Forest Plan. These standards tier to regional direction for soil managment (USDA 1992), which establish thresholds on the amount of detrimental disturbance from management activities. Detrimental soil disturbance is defined as significant changes or impairment in soil properties that are expected to result in reduced short or long-term productivity of the land (USDA 1992; USDA 1997).

The impact of timber harvesting activities on soils depends largely on the yarding method. Helicopter, skyline, and loader logging (shovel) methods proposed for the project require logs to be transported, or yarded, to truck loading areas (landings). Helicopter logging provides full suspension by flying the logs free of the ground. Skyline systems utilize yarders with suspended cables connected to towers. Depending on the topography and equipment utilized, the logs are partially or fully suspended above the ground. Loader logging (shovel) provides partial to full suspension by lifting and repositioning the logs while the loader is positioned on a slash mat gathered by the loader as it travels through the unit.

Landwehr and Nowacki (1999) and Landwehr (1993), conducted studies on detrimental soil conditions as a result of shovel, partial and full log suspension yarding. They found partial suspension yarding and shovel yarding typically result in less than 5 percent soil disturbance while full suspension yarding results in less than 3 percent detrimental soil disturbance.

Region 10 Soil Quality Standards (USDA FSM 2554 1992) require leaving at least 85 percent of an activity area in an acceptable condition for trees and other managed vegetation. Based on the existing Tongass National Forest soil quality monitoring data (Landwehr and Nowacki 1999, Landwehr 1993) all proposed harvest units would leave at least 85 percent of the harvested area in acceptable condition for trees and other managed vegetation. Due to gentle slopes over most areas and shallow, well drained, benchy and cliffy soils on steep slopes, soil mass wasting is not anticipated following implementation of the any of the proposed activities.

The project was designed to limit timber harvest on steep areas (greater than 72 percent slope) to less than one *contiguous* acre for most of the units. However, log corridors would be cut to facilitate log yarding on greater than 72 percent slopes where exceeding or near the 1 acre limit as initially detailed for units 560-403, 560-417, 587.2-414 and 587.2-419 (USDA Tuxekan DEIS 2005). Field reconnaissance indicates that in all cases the steep slopes are essentially limestone cliffs with thin well drained soils (McGilvery and Sarkar Soil Series) with a low or moderate landslide potential. The steep slope areas are included in these

harvest units to facilitate uphill yarding. In most cases the harvest on the steep slopes is limited to yarding corridors. No soil mass movement is anticipated from this limited harvest on steep slopes in all alternatives. Partial or full suspension is required when yarding over these steep slopes to limit the amount of soil displacement (see Unit Cards in Appendix B).

No roads are proposed on greater than 67 percent slopes; all proposed roads would be constructed on slopes less than 35 percent gradient.

The alternatives vary in surface erosion risk depending on the amount of clearcut harvest on moderate to steep slopes (Issue 1 – Measure 1SP1). Soil erosion models were not sensitive enough to show differences across units, therefore the acres of clearcut harvest on 30 to 72 percent slopes is used to assess erosion risk. Of the silvicultural systems proposed, clearcut-logging systems would lead to higher changes in soil moisture and may have higher risk of soil surface erosion. With the complete removal of the tree canopy, soil moisture may increase from less transpiration and evaporation from overstory trees, possibly resulting in higher overland flows and more soil erosion.

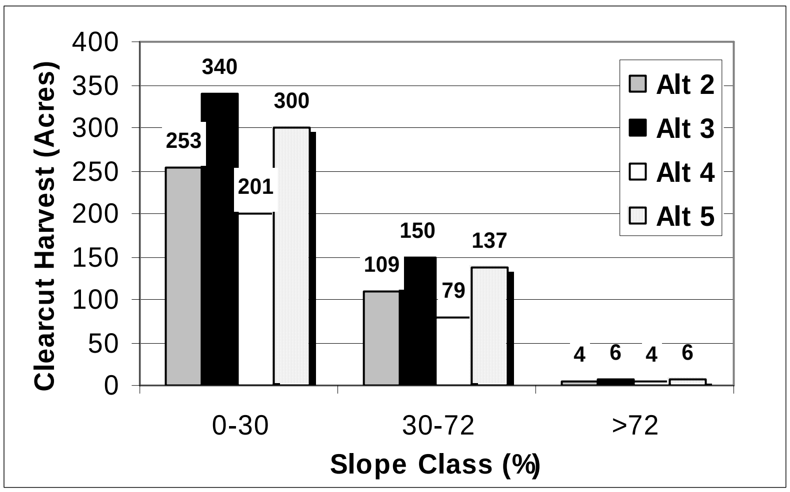

Figure 3-2. Measure 1SP1 Soil erosion: Slope evaluation using harvest acres on steep slopes (30-72%) - clearcut acreage within slope classes 0-30, 30-72, and >72 percent

Overall, the alternatives would result in different levels of detrimental disturbance from road building and timber harvest (Issue 1 – Measure 1SP2). Roads displace and/or bury soil under a layer of shot rock thereby reducing the soil productivity of the site. Unless rehabilitated rock pits leave areas of exposed rock, thereby reducing site productivity.

Each alternative would result in different levels of detrimental disturbance from timber harvest, road construction and rock pit development. Table 3-6 sums the acres of estimated detrimental disturbance following implementation of each alternative. Only temporary roads are considered detrimental since system roads are dedicated resources and not part of the productive land base. Experience has shown that one two acre rock pit would be needed for each two miles of road, or one acre of rock pit disturbance per 3.6 acres of road built assuming an average road width of 30 feet. Estimates of detrimental soil conditions within harvest units are based on the upper bound results from Tongass NF monitoring (Landwehr and Nowacki 1999, and Landwehr 1993).

Table 3-6. Measure 1SP2 Soil productivity: Total acreage of detrimentally disturbed soil estimated by alternative

	Alt 2	Alt 3	Alt 4	Alt 5
Timber Harvest	20	27	17	24
Temporary Road Construction	14	22	10	19
Rock Pit Excavation	4	6	3	6
Total Detrimental Acres	38	55	30	49

Table 3-7 details the percentage of detrimental disturbance within units to illustrate compliance with R10 Soil Quality Standards (USDA FS 1992) since typically the treatment units are the analysis reference. Units 556-409, 556-412, 557-404, 560-403, 560-408, 560-409, 560-416, and 587.2-412 have relatively higher detrimental disturbance from combined timber harvest and road building activities. Units 557-404, 560-403, 560-408, 560-409, 560-416, and 587.2-412 have higher detrimental distrubances because these units are small with a proportionally high amount of road building within the units. Under all alternatives the Regional Soil Quality Standards would be met, and soil productivity would be maintained.

Table 3-7. Estimated acres of detrimental disturbance from harvest activities and temporary road construction by harvest unit.

Unit	Alt 2	Alt 3	Alt 4	Alt 5
556-409	11	11	11	11
556-410	3	3	0	3
556-412	0	12	0	7
556-451	3	3	3	3
556-452	0	6	0	0
557-402	5	5	5	0
557-403	5	5	5	5
557-404	11	11	11	11
557-405	8	8	8	8
557-426	3	3	3	3
557-427	3	3	3	3
557-433	6	3	3	3
560-401	8	6	6	6
560-402	8	8	8	8
560-403	11	11	0	11
560-404	5	5	5	5
560-405	6	6	6	5
560-406	5	5	0	0

Table 3-7. Estimated acres of detrimental disturbance from harvest activities and temporary road construction by harvest unit.

Unit	Alt 2	Alt 3	Alt 4	Alt 5
560-407	0	9	9	9
560-408	0	12	3	12
560-409	0	10	0	10
560-411	0	4	4	3
560-412	3	3	3	3
560-416	0	10	10	10
560-417	0	9	9	9
560-426	8	8	0	8
560-428	7	7	0	7
587.2-412	11	11	0	13
587.2-413	9	9	0	9
587.2-414	5	5	5	5
587.2-417	5	5	5	5
587.2-419	7	7	7	7
587.2-424	7	7	7	7
587.2-425	5	5	5	5
Total	**168**	**235**	**144**	**214**

Soil Direct / Indirect Effects Specific to Alternative 2

Alternative 2 would meet Forest Plan standards for soil productivity. Alternative 2 has the second lowest impact to soils of the action alternatives due to limited amount of road building and proposed harvest. This alternative would result in approximately 38 acres of detrimental soil disturbance (Table 3-6). Alternative 2 poses less risk for surface erosion than Alternatives 3 and 5, though it poses a higher risk than Alternatives 4 and 1. Under Alternative 2, 362 acres of clearcut with reserves and 79 acres of single-tree harvest using conventional and helicopter systems are proposed. Of this, 109 acres occurs on slopes from 30 to 72 percent that have higher erosion potential (Figure 3-2). Skyline and/or helicopter logging methods that minimize ground disturbance are proposed for any area susceptible to active erosion (see Unit Cards in Appendix B).

Four acres cumulatively have slopes greater than 72 percent (Figure 3-2). Units 560-403, 587.2-414, and 587.2-419 have limestone cliff areas with greater than 72 percent slopes. Corridors would be cut through trees in these areas to facilitate yarding of logs from lower slopes. Unit 560-417, which would have corridors cut on greater than 72 percent slopes is not included in this alternative.

Alternative 2 proposes 6.2 miles of new roads including approximately 3.1 miles of temporary roads. In this alternative, and in all remaining action alternatives, all proposed roads are located on slopes less than 35 percent gradient.

Soil Direct / Indirect Effects Specific to Alternative 3

Alternative 3 would meet Forest Plan standards for soil productivity. Alternative 3 has the highest risk for impacting soil productivity with the largest harvest acreage and road building proposed. This alternative would result in an estimated 54 acres of detrimental soil disturbance (Table 3-6). Approximately 491 acres of clearcut with reserves and 79 acres of single-tree harvest are proposed. Erosion risk is mainly from 150 acres of clearcut harvest on slopes 30-72 percent (Figure 3-2).

Alternative 3 includes 6 acres of limestone cliff areas that have greater than 72 percent slopes. The steep slope areas are in units 560-403, 560-417, 587.2-414, and 587.2-419. Skyline corridors would be cut to facilitate timber extraction from areas below.

Alternative 3 proposes 9.6 miles of new road construction, 4.9 miles of which would be temporary road. Alternative 3 has a higher risk for soil erosion than all other alternatives with the greatest temporary road construction in addition to locating 0.25 miles temporary road across steep slopes for unit 556-412, though under 67 percent gradient.

Soil Direct / Indirect Effects Specific to Alternative 4

Alternative 4 would meet Forest Plan standards for soil productivity. Since Alternative 4 has the least amount of timber harvest and least amount of road building, Alternative 4 would have the lowest risk for impacting long-term soil productivity of the action alternatives. This alternative would result in approximately 30 acres of detrimental soil disturbance (Table 3-6). Alternative 4 proposes 284 acres of clearcut with reserves and 98 acres of single-tree harvest. Of the clearcut harvest, only 79 acres occurs on moderate to steep terrain (30-72 percent slopes), so the erosion risk is the lowest of all action alternatives.

Alternative 4 includes 4 acres total of timber harvest on slopes over 72 percent gradient (Figure 3-2). Units 560-417, 587.2-414, and 587.2-419 have limestone cliff areas with slopes over 72 percent gradient where corridors would be cut to facilitate yarding of logs from lower slope areas.

Alternative 4 proposes the construction of a total of 6.0 miles of road; 2.1 miles of this amount would be temporary road. All roads are located on slopes less than 35 percent gradient.

Soil Direct / Indirect Effects Specific to Alternative 5

Alternative 5 would meet Forest Plan standards for soil productivity. Alternative 5 would have the second greatest impact to soils. This alternative would result in 49 acres of detrimental soil disturbance (Table 3-6). Alternative 5 would have lower risk to long-term productivity than Alternative 3 due to lower impact project design features. Alternative 5 lowers risk by switching to full suspension helicopter yarding in unit 560-411 and the southwest portion of 556-412. Alternative 5 does not include clearcut harvest and associated road building in units 556-452 and 560-406. Alternative 5 moves the planned temporary road to lower gradient slopes for unit 556-412.

Approximately 444 acres of clearcut with reserves and 79 acres of single-tree harvest are proposed. Erosion risk is mainly from 137 acres of clearcut harvest on slopes 30-72 percent (Figure 3-2).

Alternative 5 includes approximately 6 acres of steeper limestone cliff areas, on slopes greater than 72 percent (Figure 3-2). The steep slope areas occur in units 560-403, 560-417, 587.2-414, and 587.2-419. Skyline corridors would be cut through these areas to facilitate timber extraction from areas below.

Alternative 5 proposes 8.8 miles of new road construction including 4.5 miles of temporary road. Alternative 5 has less impact on soils than Alternative 3 by harvesting less acres on 30 to 72 percent slopes, building less road and moving unit 560-411 to full suspension helicopter yarding.

Soil Cumulative Effects

Cumulative effects result from the incremental effects of past, present, and reasonably foreseeable future actions. Past management included timber harvet and road construction. Approximately 44 percent of the island area has experienced some form of timber harvest. Early timber harvest involved clearcut and select harvest of spruce logs using A-frame yarders floating just off-shore. In later years roads were used to access timber and currently 60.9 miles of roads exist on the island. Current actions include precommercial thinning on 1,290 acres in second growth forest.

Windthrow continues to occur, especially on the edges of clearcuts and second-growth stands on the western side of the island. No reasonably foreseeable future actions, besides the proposed action, are currently on the Forest Schedule of Proposed Actions (SOPA). When considering cumulative effects within proposed harvest areas, estimated long-term impacts from the combined past, present and reasonably foreseeable future actions will meet Region 10 Soil Quality Standards (Issue 1 – Measure 1SP2). Soil productivity will be maintained.

The analysis found a small amount of past harvest occurred within proposed harvest areas. Table 3-8 shows legacy logging from the 1940s and 1960s in units 556-410, 560-409 and 560-417. These acreage estimates are based on an overlay of managed stands with proposed harvest units.

Some proposed harvest units include a few acres previously selectively logged with A-frame yarding methods. The proposed harvest units include edges of stands where past selective harvest occurred. Past harvest with A-frame yarders and spar trees left greater soil disturbance than more recent cable yarding designs or shovel tractor methods. However, stand edges where A-frame yarding was used have comparitively less soil disturbance than where operations were concentrated in the middle of the unit. Based on field reconnaissance in the proposed harvest units with past harvest activity (Table 3-7), estimated soil disturbance from past harvest is five percent detrimental disturbance, which is the upper limit of detrimental conditions found by Landwehr and Nowacki (1999) for cable yarding systems.

Table 3-8. Past timber harvest acres within proposed treatment units. Units are displayed if at least one acre of past harvest was evident.

Decade	Unit	Alt 2	Alt 3	Alt 4	Alt 5
1940	**556-410**	3.8	3.8	0.0	3.8
1960	**560-409**	0.0	1.3	0.0	1.3
1940	**560-417**	0.0	3.5	3.5	3.5

In some cases proposed harvest units include existing temporary roads that pass through the unit. Past activities would affect soil productivity primarily from road building and secondarily from logging systems within harvest units. Most impacts from past activites in the proposed harvest units are from temporary or abandoned roads. Roads have a longer-term legacy on soil processes due to the compacted surface and soil excavation. Soil disturbance from old non-system logging roads is calculated at 100 percent of the road corridor with an average road prism width of 30 feet. System roads are not considered as past disturbance since these are dedicated resources and removed from the productive land base.

Past and ongoing pre-commercial thinning activities are not anticipated to adversely affect soil productivity. These activities do not incorporate mechanized equipment and thus do not incur physical soil disturbance. The residual slash would not have adverse effects on soil productivity.

To assess the cumulative impact of past harvest impacts and proposed treatment units, past disturbance from timber harvest and temporary road building was tallied and combined with predicted effects within proposed harvest areas. The results are displayed in Table 3-9.

Table 3-9. Cumulative percent detrimental soil conditions for past and proposed road and harvest by proposed harvest unit and alterntive. Only proposed treatment areas where past impacts were evident are displayed. Figures are percent of proposed harvest area.

Unit	Alt 2			Alt 3			Alt 4			Alt 5		
	Exist	Plan	Total	Exist	Plan	Total	Exist	Plan	Total	Exist	Plan	Total
556-409	0.3	10.6	**10.9**	0.3	10.6	**10.9**	0.3	10.6	**10.9**	0.3	10.6	**10.9**
556-410	1.8	3.0	**4.8**	1.8	3.0	**4.8**	0.0	0.0	**0.0**	1.8	3.0	**4.8**
556-412	0.0	0.0	**0.0**	0.3	12.3	**12.6**	0.0	0.0	**0.0**	0.3	7.0	**7.3**
557-404	1.1	11.4	**12.5**	1.1	11.4	**12.5**	1.1	11.4	**12.5**	1.1	11.4	**12.5**
560-402	0.0	8.2	**8.2**	0.0	8.2	**8.2**	0.0	8.2	**8.2**	0.0	8.2	**8.2**
560-403	0.7	11.4	**12.1**	0.7	11.4	**12.1**	0.0	0.0	**0.0**	0.7	11.4	**12.1**
560-404	5.8	5.0	**10.8**	5.8	5.0	**10.8**	5.8	5.0	**10.8**	5.8	5.0	**10.8**
560-406	2.0	5.0	**7.0**	2.0	5.0	**7.0**	0.0	0.0	**0.0**	0.0	0.0	**0.0**
560-407	0.0	0.0	**0.0**	0.0	9.4	**9.4**	0.0	9.4	**9.4**	0.0	9.4	**9.4**
560-408	0.0	0.0	**0.0**	2.1	11.5	**13.6**	2.1	3.0	**5.1**	2.1	11.5	**13.6**
560-409	0.0	0.0	**0.0**	0.3	9.5	**9.8**	0.0	0.0	**0.0**	0.3	9.5	**9.8**
560-412	0.4	3.0	**3.4**	0.4	3.0	**3.4**	0.4	3.0	**3.4**	0.4	3.0	**3.4**
560-417	0.0	0.0	**0.0**	0.7	9.2	**9.9**	0.7	9.2	**9.9**	0.7	9.2	**9.9**
560-426	0.6	8.4	**9.0**	0.6	8.4	**9.0**	0.0	0.0	**0.0**	0.6	8.4	**9.0**
560-428	1.4	6.8	**8.2**	1.4	6.8	**8.2**	0.0	0.0	**0.0**	1.4	6.8	**8.2**
587.2-413	4.0	9.1	**13.1**	4.0	9.1	**13.1**	0.0	0.0	**0.0**	4.0	9.1	**13.1**
587.2-425	2.3	5.0	**7.3**	2.3	5.0	**7.3**	0.2	5.0	**5.2**	2.3	5.0	**7.3**

Based on the estimates provided in Table 3-9, all proposed timber harvest areas for all alternatives would meet the Region 10 Soil Quality Standards and soil productivity will be maintained. All alternatives would have past and planned activities below the 15 percent threshold and therefore would comply with the Tongass NF plan for the soils resource. These estimates consider only the proposed harvest area so as not to dilute estimates with reserved unit acres.

The presence of old non-system roads make up the majority of past harvest disturbance. Units 560-404 and 587.2-413 had the highest residual impact with 5.8 percent and 4.0 percent detrimental disturbance respectively primarily from old roads (Table 3-9). Old roads also had proportionally greater effects on smaller units. Proposed harvest within the units with high residual soil disturbance is 4 acres for 560-404 and 21 acres for 587.2-413 (Table 2-1).

To account for proposed road building outside harvest units in the context of past harvest and road building, detrimental disturbance was calculated by watershed. Table 3-10 shows the estimated cumulative impact of each alternative on detrimental disturbance by watershed. Watersheds where the action alternatives increased total detrimental disturbance at least one percent include # 1, 3, 6, 7, 18, and 19. The alternatives are ranked from greatest to least impact: Alternative 3, Alternative 5, Alternative 2, and Alternative 4.

Table 3-10. Cumulative watershed soil detrimental disturbance (%) by alternative. Soil disturbance was assigned for past harvest at 5 percent, roads at 100 percent (40 foot wide corridor) and rock pits at 100 percent (1 acre of rock pit per road mile).

Watershed	Area (acres)	Past Harvest (acres)	Roads (mi)	Rock Pits (#)	Alt 1 (%)	Alt 2 (%)	Alt 3 (%)	Alt 4 (%)	Alt 5 (%)
1	1,208	494	4.4	5	3.8	4.8	4.8	4.4	4.8
2	476	108	1.7	2	2.9	2.9	2.9	2.9	2.9
3	639	219	4.0	5	4.8	6.2	6.2	5.3	6.2
4	1,279	420	5.6	6	3.7	3.9	3.9	3.9	3.9
5	3,519	1,011	11.1	12	2.9	3.2	3.3	3.2	3.2
6	2,025	1,447	10.3	11	6.0	6.0	6.7	6.4	6.7
7	666	508	5.6	6	7.8	7.8	8.6	8.1	8.5
8	1,005	264	2.7	3	2.6	2.6	2.7	2.6	2.7
9	1,487	617	3.4	4	3.2	3.4	3.4	3.4	3.4
10	260	96	0.6	1	3.0	3.1	3.1	3.1	3.1
11	437	272	1.7	2	5.0	5.0	5.0	5.0	5.0
12	821	499	4.0	5	5.4	5.5	5.8	5.5	5.5
13	128	0	0.0	0	0.0	0.0	0.0	0.0	0.0
14	397	38	0.0	0	0.5	0.5	0.5	0.5	0.5
15	161	125	1.0	2	7.5	7.5	7.5	7.5	7.5
16	529	391	2.8	3	6.2	6.2	6.2	6.2	6.2
17	334	206	0.2	1	3.6	3.7	3.6	3.7	3.6
18	751	119	0.4	1	1.1	2.3	2.3	2.3	2.3
19	381	190	1.3	2	4.3	5.8	5.8	5.8	5.8
20	882	731	6.0	6	7.3	7.3	7.3	7.3	7.3
21	342	89	0.0	0	1.3	1.3	1.3	1.3	1.3

Irreversible and irretrievable effects from the proposed action alternatives would occur from rock pit excavation associated with road building and road construction. Both activities would remove or bury the soil eliminating soil function. Alternatives 3 and 5 would have the

highest effects based on road mileage per watershed (see Table 3-10). Alternatives 2 and 4 have similar watershed disturbance at this scale.

Hydrology

Table 3-11 summarizes the analysis of results used to compare effects to hydrology for Issue 1. Additional information regarding the hydrology analysis is provided below. For the complete hydrology analysis, please refer to the specialist's report for hydrology located in the planning record.

Table 3-11. Issue 1: Hydrology measures

Measure		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1H1 Percent increase in disturbed acres from harvesting, temporary and NFS roads within Riparian Management Areas (RMAs).		0	0.1	0.1	0.1	0.1
		With regard to cumulative effects to RMAs within the project area, only 0.1% of RMAs would be disturbed by timber harvest and road building activity by any of the action alternatives, as well as all future projects, proposed within the Tuxekan cumulative watershed effects area.				
Measure	**Watershed**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
1H2 Percent of watershed disturbance by proposed and past timber harvesting and roads proposed or built between1981 and 2011.	1	5	11	11	8	11
	2	11	12	12	12	12
	3	8	14	14	10	14
	4	5	6	6	6	6
	5	10	13	14	12	13
	6	0	0	4	3	4
	7	7	7	13	10	12
	8	3	3	3	3	3
	9	5	7	7	7	7
	10	10	12	12	12	12
	11	6	6	6	6	6
	12	11	13	14	12	13
	13	0	0	0	0	0
	14	10	10	10	10	10
	15	5	5	5	5	5
	16	8	8	8	8	8
	17	7	8	8	7	8
	18	3	10	10	10	10
	19	7	13	13	13	13
	20	9	9	9	9	9
	21	11	11	11	11	11
	All project area watersheds will be below the 20% threshold of concern for water yield in 2011 after implementation of the King Tux and Tuxekan Projects.					
Measure		**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
1H3 Acres of wetlands disturbed out of 2,661 acres of wetlands present within the Tuxekan Project cumulative watershed effects area.		0	3.1	3.1	3.1	3.1
		In regards to cumulative effects to wetlands within the project area, only 3.1 of 2,661 project area wetland acres would be disturbed by timber harvest and road building activity by any of the action alternatives, as well as all future projects, proposed within the Tuxekan cumulative watershed effects area.				
1H4 Total number of all stream crossings		44	51	54	53	54
		Alternative 2 proposes 7 stream crossings. Alternatives 3 and 5 propose 10 stream crossings while Alternative 4 proposes 9. This is at most a 20% increase in sream crossings for the project area.				

Hydrology General Affected Environment

The analysis area used for direct/indirect and cumulative effects for the hydrology resource is the 17,730-acre Tuxekan Island. The project area has been divided into 21 individual watersheds that are shown in Figure 3-3. Twelve of these drainages contain at least third-order stream networks, nine include a lake and stream network, and 17 contain fish-bearing streams. Table 3-12 lists these watersheds, their sizes and where they flow. See the “Watershed Delineation” section under the “Data Collection Methods” below for information on how watershed boundaries were derived for the Tuxekan Project Area.

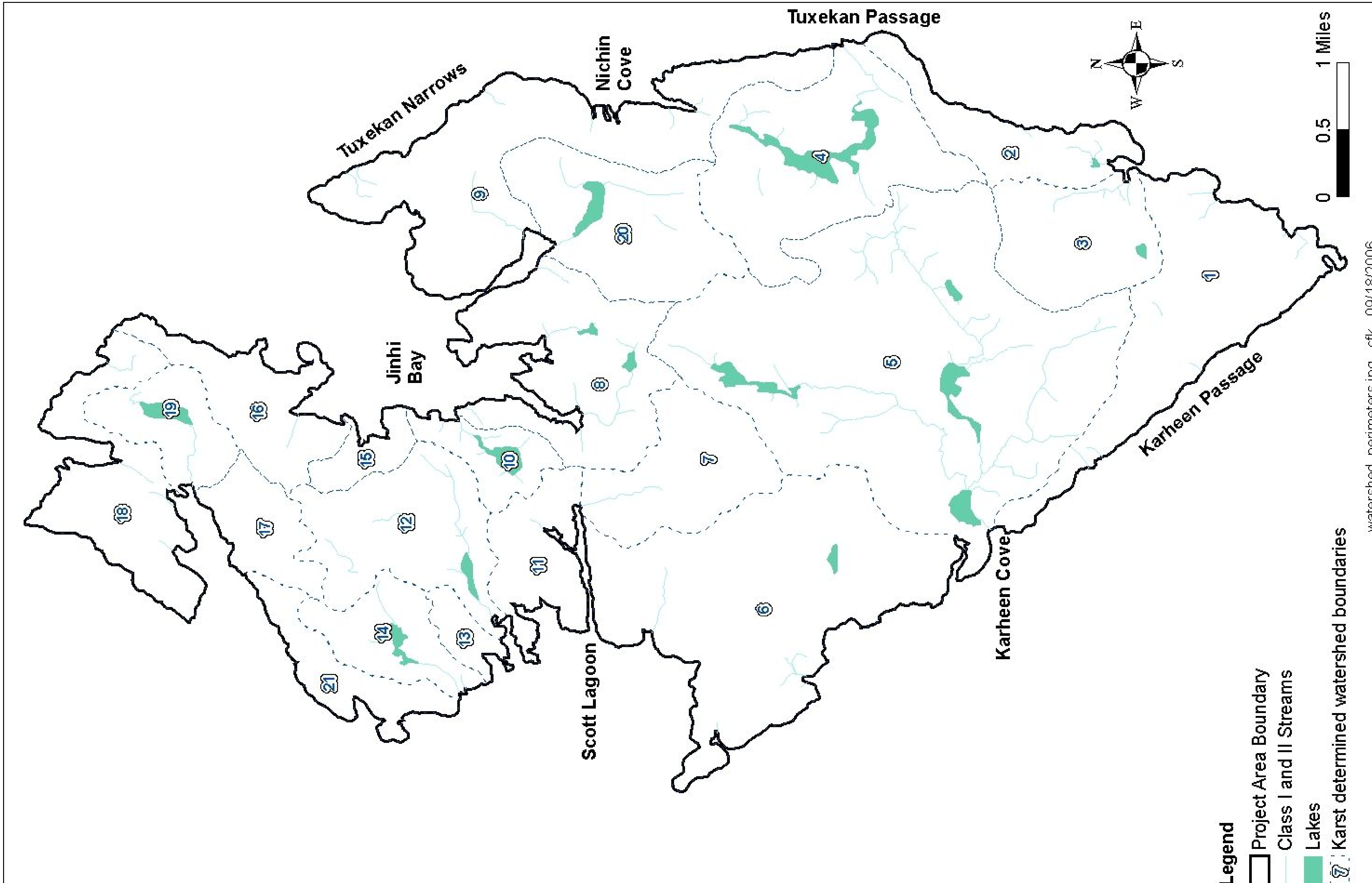

Figure 3-3. Location map of watersheds within the Tuxekan Project Area

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Table 3-12. Watersheds within the Tuxekan project area, size, and where they flow

Watershed Number	Size		Tributary to:
	Acres	Sq. Miles	
1	1,209	1.9	Karheen Passage and Tuxekan Passage
2	476	0.7	Tuxekan Passage
3	639	1.0	
4	1,279	2.0	
5	3,519	5.5	Karheen Passage
6	2,025	3.2	Scott Lagoon and Karheen Passage
7	666	1.0	Scott Lagoon
8	1,005	1.6	Jinhi Bay
9	1,487	2.3	Tuxekan Narrows, Tuxekan Passage, Jinhi Bay and Nichin Cove
10	260	0.4	Jinhi Bay
11	437	0.7	Scott Lagoon
12	821	1.3	Sea Otter Sound
13	127	0.2	
14	397	0.6	
15	161	0.3	Jinhi Bay
16	529	0.8	
17	334	0.5	El Capitan
18	751	1.2	
19	381	0.6	
20	882	1.4	Jinhi Bay
21	342	0.5	El Capitan
Total	**17,727**	**27.7**	

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Timeframe for Analysis

Past management on Tuxekan Island includes timber harvesting, road construction, and limited mining activity. For timber harvesting, the Forest Plan suggests a threshold of concern when a watershed exceeds 20 percent of its area in second growth forests younger than 30 years (USDA FS 1997a, Appendix J). For the purpose of the Tuxekan Project, implementation is expected to take place between 2006 and 2012. Disturbance from timber harvesting was analyzed through this time period.

In contrast to timber harvesting, once a road is constructed, hydrological effects continue until the road is obliterated and rehabilitated. For the roads on Tuxekan Island, effects began with road construction in the 1920s and continue to present, because roads on the Tongass are typically only decommissioned. Decommissioned roads, while allowing for natural drainage patterns to be restored, still impact water yield because the impermeable road prism is still present. Road disturbance acres were included within the 30-year disturbance timeframe to give a more accurate picture of disturbance within each project area watershed. Disturbance from roads is calculated in the 30-year disturbance interval for harvesting

described above. Roads are assumed to be a permanent disturbance until obliterated and rehabilitated.

Within the project area, one mining claim covers a portion of proposed harvest unit #560-406. The claim covers 25 acres and is used to extract colored re-crystallized limestone for sculpture, tile, and ornamental applications. Excavation is limited and there has been no blasting. This claim is anticipated to continue for many years. Ground disturbance has been and would continue to be minimal (less than one acre).

Assessment of upcoming harvesting projects would be projected seven years into the future. This is when implementation of the Tuxekan Project is to be completed. The only project currently scheduled on Tuxekan Island, other than the Tuxekan Project, is the 1,291-acre King Tux Pre Commercial Thinning Project. At this time, the King Tux Pre Commercial Thinning Project is scheduled to be completed in the next two to three years.

Data Collection Methods

The data used for this hydrology assessment is a collection of reference information, field data collected during the summer of 2000 by URS (a contractor), and the Forest Service Geographic Information System (GIS) database. URS field data included collecting stream information as well as inventorying karst vulnerability for determining and assessing impacts to hydrologic function. Road condition surveys (RCS) with data from 1999 through 2005 were used for road information.

Streams

Tongass stream information was updated using field information collected by URS field personnel during the summer of 2000, and by analysis of aerial photographs. The field-verified information was limited to proposed harvest units and the area just outside unit boundaries. URS personnel incorporated the updated stream lengths into GIS for project analysis.

The presence of limestone bedrock on Tuxekan Island results in karst geography and a complex interconnectedness of surface and subsurface waters. Surface waters can quickly disappear into the subsurface karst network through sinkholes and other karst features. Water can also emerge from the subsurface through caves and other karst features and flow into surface water streams. The processes of waters flowing through karst and the potential effects of forest management on the Tuxekan Island karst is discussed in the Karst Systems section of Chapter 3.

Watershed Delineation

Delineation of watershed boundaries for the Tuxekan Project Area addressed the complexities of surface and subsurface hydrologic networks imposed by karst environments. The existing Tongass watershed boundaries were derived using hydrologic unit codes (HUC). The HUC methodology primarily follows surface topography for delineating watershed boundaries. In a karst environment, runoff does not necessarily follow surface topography. Furthermore, surface streams in karst areas often flow into subsurface networks and cross-topographic boundaries. For this reason, watershed boundaries in karst environments incorporate subsurface flow paths into watershed boundary delineation. Hence,

the watersheds in this report are karst watersheds and coastal polygons. In determining these boundaries, dye-tracing information was used initially, followed by surface water pathways and, finally, topographic boundaries. This methodology for delineating watershed boundaries in karst areas is discussed in Veni (1999). Existing dye-tracer information is limited to insurgences and resurgences that have been sampled. Additional dye-tracer tests may reveal new subsurface connectivity and therefore additional changes to the watershed boundaries. This results in an iterative process of boundary delineation as additional information is acquired.

Road Information

Road information is a compilation of data from various sources. The road lengths were queried from the Tongass GIS roads inventory. Watershed road densities were calculated using road lengths of existing and decommissioned roads and watershed area. Road condition has been interpreted from the RCS completed on Tuxekan Island between 1999 and 2005 (USDA FS 2005e). The RCS information was contained in a spreadsheet and identified by mileage along identified roads. These mile marks were interpreted on a milepost map for use in this assessment. The Tuxekan Project access management plan identifies certain roads for storage, storm proofing, or decommissioning within the project area, depending upon current condition and future needs. All roads scheduled for decommissioning are unauthorized roads.

Harvest Percentages

Harvest percentages are presented as the amount of productive old growth[1] (POG) that has been harvested compared to the amount of POG that existed prior to harvesting. Using GIS data layers, each watershed was queried for both original POG and harvested area. Some watersheds encompass State of Alaska land. Therefore, the harvested percentages in these watersheds may not reflect the true harvested acreage and density information.

Individual Watershed Assessments

Individual watershed assessments have been made for watersheds with activities proposed in this project. Tables and information used in the individual watershed assessments are presented in Appendix A of the “Final Watershed Assessment Report for the Tuxekan Island Timber Sale” (URS) as well as the supplement to the “Final Watershed Assessment Report for the Tuxekan Island Timber Sale” completed by the USDA Forest Service TEAMS Enterprise Unit.

Climate and Elevation

The climate of the Tuxekan Project Area is humid and temperate. Annual precipitation is between 78 and 118 inches, contributing to an estimated 144,000 acre-feet of annual rainfall-generated runoff. Winter snow is common in the upper elevations and more sporadic in the lower elevations, depending upon winter storm cycles. Elevations within the project area range between sea level and approximately 1,880 feet.

[1] See FSM 7703.2 Management Opportunities for definition of decommission. All roads proposed for decommissioning within the project area are existing unauthorized roads or temporary roads proposed by this project.

Soils and Geology

Please see both the *Soils* and *Karst Systems* sections *Under Chapter 3, Issue 1*.

Water Quality

At least one water quality sample was collected for pH, conductivity, and temperature in all project area watersheds except watersheds 2, 10, 13, and 21. This data was collected by URS and can be found in Appendix D of the "Draft Watershed Assessment Report for the Tuxekan Island Timber Sale" located in the project record. Water chemistry was collected to help evaluate whether water flowing in these systems came from subsurface karst systems. Generally, waters emerging from subsurface karst in southern Southeast Alaska have a pH ranging between 7.8 and 8.0 and conductivity greater than 100 pS/cm (Baichtal 2002). Conclusions regarding water quality samples can be found in Section 3.0 "Assessment Results by Watershed" in the "Draft Watershed Assessment Report for the Tuxekan Island Timber Sale" located in the project record.

Water quality refers to the physical, chemical, and biological components of a given stream and its assigned beneficial use classes. In Alaska, beneficial use classes are referred to as protected water use classes.

The designated protected water use classes for the Tuxekan Project cumulative watershed effects area is for the growth and propagation of fish, shellfish, other aquatic life, and wildlife.

To determine compliance with the Clean Water Act and the State of Alaska water quality criteria and standards, two reports are required: the Section 305(b) reports documents those water bodies that are not meeting water quality criteria. Section 303 (d) requires states to identify waters for which effluent limitations are not stringent enough to meet water quality standards. Examination of the State of Alaska 2002/2003 Integrated Water Quality Monitoring and Assessment report indicates that no streams in the project area have been listed as water quality impaired.

Past Disturbance

Timber Harvesting

Timber harvesting has occurred within the Tuxekan Project Area since the 1920s. Past timber harvesting by watershed and decade is shown in Table 3-13. Timber harvest has the potential to affect hydrology through changes in sediment and water yield, riparian and wetland function, and large woody debris input to name a few. These topics are discussed below under the "Environmental Consequences" section.

Table 3-13. Acres of timber harvesting by decade since the 1920s (start of timber harvesting in the area) within each of the Tuxekan project area watersheds

Watershed	Size	Harvesting by Decade (Acres)									
		1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	Total
1	1,209	4	7	154	0	0	22	307	0	0	494
2	476	0	0	0	0	0	41	67	0	0	108
3	639	0	0	32	0	0	2	186	0	0	220
4	1,279	0	0	0	0	334	0	61	9	16	420
5	3,519	0	0	78	0	90	307	448	40	47	1,010
6	2,025	0	0	117	0	945	364	20	0	0	1,446
7	666	0	0	0	0	65	399	44	0	1	509
8	1,005	0	0	22	0	91	123	29	0	0	265
9	1,487	0	0	119	118	275	46	61	0	0	619
10	260	0	0	0	0	0	69	27	0	0	96
11	437	0	0	0	0	0	244	28	0	0	272
12	821	0	0	14	0	0	395	70	20	0	499
13	127	0	0	0	0	0	0	0	0	0	0
14	397	0	0	0	0	0	0	0	38	0	38
15	161	0	0	0	1	0	115	8	0	0	124
16	529	0	0	30	0	0	321	28	12	0	391
17	334	0	0	117	0	0	65	24	0	0	206
18	751	0	0	22	28	0	48	9	13	0	120
19	381	0	0	4	1	0	162	16	3	0	186
20	882	0	0	3	0	622	24	64	14	5	732
21	342	0	0	0	0	0	52	37	0	0	89
Total	17,727	4	7	712	148	2,422	2,799	1,534	149	69	7,844

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Table 3-14 shows the percent of each watershed harvested since 1975 as well as acres of existing and decommissioned roads. For timber harvest, the Forest Plan suggests a threshold of concern when a watershed exceeds 20 percent of its area in second growth forests younger than 30 years (USDA-FS 1997a, Appendix J). For the purpose of this report, any harvest equal to or less than 30 years (1976 through current) in stand age as well as any existing or decommissioned NFS or unauthorized road has been tracked to compare threshold conditions for water yield within the proposed Tuxekan cumulative watershed effects area. Note that watersheds 1, 2, 3, and 5 are currently above the 20 percent threshold of concern for water yield.

Table 3-14. Percent of the Tuxekan Project Area watersheds disturbed by timber harvesting since 1975 including existing and decommissioned NFS and unauthorized roads.

Watershed Number	Size (acres)	Timber harvesting from 1976 through current (acres)	Existing road acres (assumes a 30 foot road width)	Existing % disturbance from past harvesting and roads for time period (1976-current)
1	1,209	328	19	29%
2	476	108	6	24%
3	639	188	17	32%
4	1,279	86	22	8%
5	3,519	839	36	25%
6	2,025	20	42	3%
7	666	44	22	10%
8	1,005	29	10	4%
9	1,487	61	12	5%
10	260	27	2	11%
11	437	28	6	8%
12	821	90	15	13%
13	127	0	0	0%
14	397	38	0	10%
15	161	8	4	7%
16	529	40	11	10%
17	334	24	1	7%
18	751	22	5	4%
19	381	19	8	7%
20	882	82	21	12%
21	342	37	0	11%

Table 3-15 shows acres of timber harvest that has occurred within RMAs since the 1920s as well as the percent of the RMA harvested. Large woody debris is an important component of Southeast Alaska rivers and streams. RMAs are areas that provide large woody debris to stream channels. Large woody debris provides channel structure and complexity important for fish habitat. Because of RMA harvesting, large woody debris may not be replaced until large diameter trees regenerate in riparian areas. In addition, the shading of stream channels by trees, which keeps water cool enough for fish to live, is impacted when riparian trees are harvested.

Table 3-15. Acres of timber harvesting by watershed within Riparian Management Areas (RMAs) since the start of timber harvesting in the 1920s within the Tuxekan project area

Watershed Number	Acres of RMA	Acres harvested in RMAs since the 1920s	Percent of RMAs harvested since 1920s
1	105	24	23
2	45	1	2
3	56	2	4
4	224	36	16
5	631	79	13
6	71	48	68
7	35	16	46
8	127	26	20
9	169	51	30
10	74	6	8
11	7	7	100
12	100	40	40
13	0	0	0
14	75	2	3
15	0	0	0
16	10	7	70
17	5	1	20
18	60	9	15
19	56	2	4
20	99	53	54
21	25	9	36
Total	1,974	419	

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Past Thinning

In the 1980s and 1990s, approximately 2,145 acres of precommercial thinning was conducted within the Tuxekan Project Area. No new temporary or NFS roads were constructed to implement this activity (see FEIS, Chapter 1).

Roads

Most roads within the Tuxekan Project Area are shot rock, with some having a gravel cap. Total road miles include current NFS and unauthorized, including decommissioned and temporary roads. Currently, there are approximately 60.9 miles of road within the Tuxekan cumulative watershed effects area. This equates to a road density of 2.2 miles of road per square mile of land. Table 3-16 displays how many miles of road currently exist as well as the road density within each of the 21 watersheds within the Tuxekan cumulative watershed effects area.

Table 3-16. Miles of existing open and decommissioned road and road density within the Tuxekan project area watersheds.

Watershed	Miles of existing and decommissioned road	Road density (miles of road per sq. mile of drainage)
1	3.6	1.9
2	1.7	2.3
3	3.3	3.3
4	5.6	2.8
5	8.8	1.6
6	9.5	3.0
7	5.2	5.0
8	2.7	1.7
9	3.2	1.3
10	0.6	1.5
11	1.6	2.4
12	3.9	3.0
13 & 14	0.0	0.0
015	1.0	4.0
16	3.1	3.4
17	0.2	0.4
18	0.0	0.0
19	1.2	2.0
20	5.7	4.1
21	0.0	0.0
Total	**60.9**	**43.7**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

As mentioned, RMAs are important resources for aquatic species as well as water quality and overall watershed health and function. Roads built within RMAs permanently remove riparian vegetation. Table 3-17 shows the current acres of existing and decommissioned NFS and unauthorized roads constructed within RMAs. Acreage is based on a 30-foot road width.

Table 3-17. Acres of existing and decommissioned roads within RMAs within each of the Tuxekan project area watersheds[a]

Watershed	Acres of existing and decommissioned road within RMAs
1	1.5
2	0.1
3	0.5
4	1.6
5	2.7
6	8.9
7	2.2
8	1.8
9	0.1
10	0.1
11	1.8
12	1.9
13-15	0.0
16	0.4
17-19	0.0
20	3.2
21	0.0
Total	**26.8**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

[a] Acreages based on a 30-foot wide road width.

Wetlands Affected Environment

Wetlands are areas that contain sufficient amounts of surface and/or ground water to support vegetation adapted for life in saturated soil conditions. Wetlands serve valuable functions in watersheds. Wetlands store runoff and release water during periods of low flow. Wetlands also capture and filter sediment and other pollutants, protecting water quality. Within the Tuxekan cumulative watershed effects area, wetlands are widespread and intimately related to soil drainage, surface water, and stream channels. Wetland types in the project area are shown in Table 3-18 and are dominated by forested wetlands and muskegs (sphagnum-dominated). Figure 3-4 illustrates the location of existing wetlands in relationship to past and proposed timber harvest units.

Table 3-18. Acres and type of wetlands within the Tuxekan project area

Watershed	FW	MP	FES	MT	EM	E
1	8.4	2.0	15.2	0.0	0.0	0.0
2	140.2	0.0	30.2	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	92.8	0.0	359.5	23.6	17.7	0.0
5	136.9	13.7	549.8	109.4	22.3	7.2
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	1.4	19.1	0.0	0.0
8	84.4	0.0	278.9	13.6	0.0	0.0
9	0.0	0.0	103.6	0.0	3.3	0.0
10	0.0	0.0	57.5	16.2	0.0	0.0
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	32.9	10.7	0.0	0.0
13	8.2	0.0	0.0	0.0	0.0	0.0
14	59.6	0.0	39.7	1.7	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	9.3	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	16.9	4.7	0.0	0.0
19	0.0	21.1	18.3	12.5	0.0	0.0
20	35.5	0.0	0.0	9.1	0.0	0.0
21	118.9	0.0	0.0	0.0	0.0	0.0
Total	**684.9**	**36.8**	**1,513.2**	**220.6**	**43.3**	**7.2**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

- FW - Forested Wetland
- MP – Moss Muskeg (Sphagnum Peat Muskeg)
- FES - Forested Wetland/Emergent Sedge Wetland Complex, < 50 Percent Forested
- MT - Emergent Tall Sedge Muskeg
- EM - Emergent Short Sedge Wetland
- E - Scrub/Estuarine

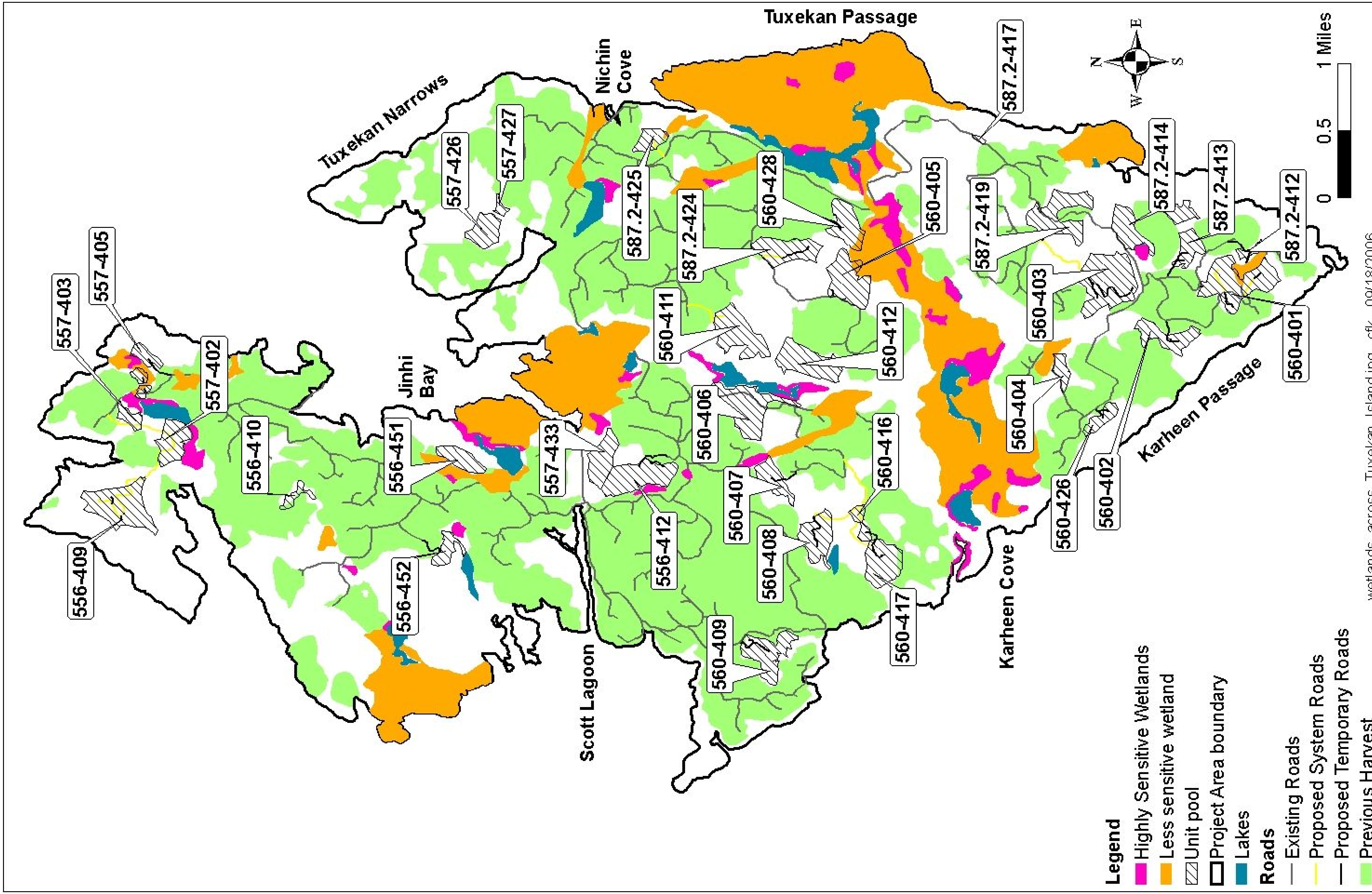

Figure 3-4. Wetlands across Tuxekan Island with proposed harvesting and roads

Wetlands Direct/Indirect Effects

Wetlands Direct/Indirect Effects Specific to Alternative 1 – No Action

Alternative 1 would not impact wetlands as it is the no action alternative.

Wetlands Direct/Indirect Effects Common to Alternatives 2, 3, 4, and 5

Effects to wetlands would be minor. Proper installation and use of BMP 12.5 would mitigate potential effects to the degree that total wetland function, integrity, and value would not be compromised. Localized impacts from shovel or cable yarding are expected in the form of soil compaction, vegetation removal, and altered hydrology. Monitoring of the effectiveness of BMP 12.5 from 1998 to 2003 showed that, "Very little to no soil disturbance was noted in the harvested wetland areas monitored". Further, the report goes on to say that, "(monitoring) trends indicate that (wetland) BMPs are being prescribed site specifically and are being fully implemented". It is anticipated that BMP 12.5 would be implemented properly for the Tuxekan Project no matter which Alternative is selected-and wetlands would be protected.

Table 3-19 shows the types and acres of wetlands within harvest treatment areas in the Tuxekan cumulative watershed effects area for each alternative.

Table 3-19. Types and amounts of wetlands within proposed harvest treatment areas in the Tuxekan Project cumulative watershed effects area by Alternative.

Wetland Type	Alt 1 (Acres)	Alt 2 (Acres)	Alt 3 (Acres)	Alt 4 (Acres)	Alt 5 (Acres)
FES	0	2.8	2.8	2.8	2.8
FW	0	0.3	0.3	0.3	0.3
Total	**0**	**3.1**	**3.1**	**3.1**	**3.1**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

In Alternatives 2 through 5, approximately 180 feet of temporary road accessing unit 557-404 will cross Forested Wetland/Emergent Sedge Wetland Complex (FES). In addition, Alternatives 2, 3, and 5 accesses unit 587.2-412 with approximately 60 feet of temporary road across FES (total of approximately 240 feet). Use of BMP 12.5 (Wetland Identification, Evaluation, and Protection; FP Appendix C, p. C-2) would mitigate effects to the degree that total wetland function, integrity, and value would not be compromised.

Wetlands Cumulative Effects

The analysis area for cumulative effects to wetlands is the 17,730 acre Tuxekan Project Area, and the timeframe is from when management activity began in the 1920s to 7 years into the future (2012). This is when all proposed projects are expected to be implemented. Tuxekan Island was chosen as the spatial boundary because it is the project area as well as the cumulative watershed effects area.

There are 2,661 acres of wetlands within the Tuxekan cumulative watershed effects area. Of these 2,661 acres, at most 3.1 acres could potentially be impacted by harvest activity with

implementation of both the Tuxekan and King Tux Pre Commercial Thinning Projects. The King Tux Pre Commercial Thinning Project would be conducted by hand sawyers. No heavy equipment would be used and no wetland disturbance is anticipated. In summary, approximately 3.1 acres, or 0.1 percent of the forested wetlands within the Tuxekan Project cumulative watershed effects area, have the potential to be impacted by soil compaction, vegetation removal, and altered hydrology. Wetlands would be avoided as much as possible. Proper installation and use of BMP 12.5 (Wetland Identification, Evaluation, and Protection; FP Appendix C, p. C-2) would mitigate effects of temporary roads across FES wetlands to the degree that total wetland function, integrity, and value would not be compromised.

Riparian Management Areas (RMAs)

Affected environment discussion for riparian resources can be found in *Chapter 3, Other Resources, Biological Environment, Fisheries*.

Riparian Management Area Direct/Indirect Effects

Riparian Management Area Direct/Indirect Effects Specific to Alternative 1 – No Action

Alternative 1 would not impact riparian resources, as it is the no action alternative.

Riparian Management Area Direct/Indirect Effects Common to Alternatives 2, 3, 4, and 5

No timber harvest would occur within Forest Plan defined RMAs in any action alternative. New temporary and NFS road would be constructed in RMAs under all action alternatives. Table 3-20 shows the acres of new temporary and NFS road to be constructed within RMAs for Alternatives 2, 3, 4, and 5. Each road is assumed to have a disturbance width of 30 feet.

Table 3-20. Acres of proposed temporary and NFS roads to be built within RMA buffers within the Tuxekan project area (Alternatives 2, 3, 4, and 5) based on 30 foot road width

Watershed	Alt 2 (Acres)	Alt 3 (Acres)	Alt 4 (Acres)	Alt 5 (Acres)
1	0.5	0.5	0.5	0.1
2	0.0	0.0	0.0	0.0
3	0.2	0.2	0.1	0.2
4	0.0	0.0	0.0	0.0
5	0.1	0.1	0.1	0.2
6	0.0	0.2	0.1	0.2
7-17	0.0	0.0	0.0	0.0
18	0.1	0.1	0.1	0.1
19	0.1	0.1	0.1	0.1
20 & 21	0.0	0.0	0.0	0.0
Total	**1.0**	**1.2**	**1.0**	**0.9**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Table 3-21 summarizes the amount of RMA that would be disturbed by both timber harvesting and road building within each of the action Alternatives.

Table 3-21. Acres of proposed timber harvesting and temporary and NFS road construction within RMA buffers in the Tuxekan project area and percent of RMA disturbed by proposed timber harvesting and road building activity by alternative

Watershed	Acres of proposed timber harvesting and road building activity within RMAs for Alternatives 2, 3, 4, and 5				Percent (%) of total RMA disturbed by proposed timber harvesting and road building activity for Alternatives 2, 3, 4, and 5			
	Alt 2	Alt 3	Alt 4	Alt 5	Alt 2	Alt 3	Alt 4	Alt 5
1	0.5	0.5	0.5	0.1	0.5	0.5	0.5	0.1
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.2	0.2	0.1	0.2	0.4	0.4	0.2	0.4
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0
6	0.0	0.2	0.1	0.2	0.3	0.3	0.1	0.3
7-17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
19	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
20 & 21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Acres	**1.0**	**1.2**	**1.0**	**0.9**	**NA**			
% of Total RMA Disturbed					**0.1**	**0.1**	**0.1**	**0.1**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

No more than 1.2 acres of RMA would be disturbed with implementation of the project. This is 0.1 percent of the total RMA within the Tuxekan Project Area-a very minor disturbance and a negligible value.

Riparian Management Area Cumulative Effects

The analysis area for cumulative effects to RMAs is the 17,730 acre Tuxekan Project Area. This was chosen because Tuxekan Island is the project area as well as the cumulative watershed effects area. The temporal boundaries go back to the start of timber harvest and road building on the island and go until 2012, when all proposed projects are expected to be implemented.

Riparian Management Area Cumulative Effects Specific to Alternative 1 – No Action

The no action alternative would result in no cumulative effects.

Riparian Management Area Cumulative Effects Common to Alternatives 2, 3, 4, and 5

Table 3-15 lists the acres of RMA harvested since timber harvesting began within the Tuxekan Project Area in the 1920s. Table 3-17 lists the current acres of existing and

decommissioned roads within RMAs. Table 3-22 was created using data from Table 3-15 and Table 3-17. Table 3-22 shows the percent of RMAs disturbed by road building and timber harvesting activity over time after including both the Tuxekan Project and the King Tux Pre Commercial Thinning Project, and Table 3-21 displays the acres and percent of the Tuxekan Project Area watersheds to be disturbed by timber harvesting and road building under all action alternatives.

Table 3-22. Percentage of RMAs disturbed by road building and timber harvesting activity over time after implementation of the Tuxekan Project and the King Tux Pre Commercial Thinning Project; and the percent increase in disturbance above existing condition caused by the Tuxekan Project and the King Tux Pre Commercial Thinning Project

Watershed	Total percent (%) of RMAs disturbed over time by road building and timber harvesting after implementation of the Tuxekan Project and the King Tux Pre Commercial Thinning Project				Percent (%) increase in disturbance above existing condition caused by the Tuxekan Project and the King Tux Pre Commercial Thinning Project			
	Alt 2	Alt 3	Alt 4	Alt 5	Alt 2	Alt 3	Alt 4	Alt 5
1	25.1	25.1	25.1	24.4	0.8	0.8	0.8	0.1
2	2.4	2.4	2.4	2.4	0.0	0.0	0.0	0.0
3	5.2	5.2	4.7	5.2	0.7	0.7	0.2	0.7
4	16.8	16.8	16.8	16.8	0.0	0.0	0.0	0.0
5	12.9	12.9	12.9	12.9	0.0	0.0	0.0	0.0
6	80.1	80.7	80.4	80.7	0.0	0.6	0.3	0.6
7	52.0	52.0	52.0	52.0	0.0	0.0	0.0	0.0
8	12.5	12.5	12.5	12.5	0.0	0.0	0.0	0.0
9	30.2	30.2	30.2	30.2	0.0	0.0	0.0	0.0
10	8.2	8.2	8.2	8.2	0.0	0.0	0.0	0.0
11	100.0	100.0	100.0	100.0	0.0	0.0	0.0	0.0
12	41.9	41.9	41.9	41.9	0.0	0.0	0.0	0.0
13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	2.7	2.7	2.7	2.7	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	74.0	74.0	74.0	74.0	0.0	0.0	0.0	0.0
17	20.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0
18	15.3	15.3	15.3	15.3	0.0	0.0	0.0	0.0
19	3.8	3.8	3.8	3.8	0.0	0.0	0.0	0.0
20	56.8	56.8	56.8	56.8	0.0	0.0	0.0	0.0
21	36.0	36.0	36.0	36.0	0.0	0.0	0.0	0.0
Average % Change by Alternative	**29.5**	**29.5**	**29.4**	**29.4**	**0.1**	**0.1**	**0.1**	**0.1**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Based on the tables above, future projects within the Tuxekan Project Area would increase disturbance from 22.5 percent to 22.6 percent. This is a 0.1 percent increase. Only minimal

disturbance would occur within RMAs from future projects. Overall, riparian function, integrity, and value would be protected.

Water Yield Affected Environment

The relationship between removal of vegetation (timber harvesting and road building) and increases in water yield are well established (USDA 1976) (Bosch and Hewlett 1982). Climate primarily determines the magnitude of large flood events (Dunne and Leopold 1978). However, land use practices have been shown to increase peak flows as well (Troendle and Kaufmann 1987). The reduction in tree density (i.e. canopy cover) and increase in non-permeable surfaces, related to roads, results in a reduction in the amount of transpiration of groundwater and also the amount of canopy interception of rainfall/snowfall, which increases the amount of the precipitation available for runoff as stream flow. This is the water yield increase associated with timber harvesting and road construction in a watershed. The amount of water yield increase declines to pre harvest levels or below pre-harvest levels as the tree canopy recovers with re-growth after harvesting and/or after roads have been obliterated and rehabilitated and regrowth occurs (Hicks et al. 1991).

To address the topic of increased stream flow (both annual and summer low flow), the Forest Plan, in line with Hicks et al. 1991; and Jones 2002 suggests a threshold of concern when a watershed exceeds 20 percent of its area in second-growth forests younger than 30 years (USDA-FS 1997a, Appendix J) (Coffin and Harr 1992). For the purpose of this analysis, any harvesting equal to or less than 30 years in stand age has been tracked to compare threshold conditions for water yield within the Project Area.

This 30-year theory is still under considerable scrutiny since past studies have yielded various responses. A study of the evapotranspiration response within the Maybeso Watershed (located south and east of the Planning Area on Prince of Wales Island) displayed no significant changes in stream flow when 25 percent of the basin was harvested (James 1956; Meehan et.al., 1969). An analysis of the nearby Staney Creek basin showed increases in mean and summer low flow when harvesting reached 20 to 25 percent of the basin area (Bartos 1989).

The literature supports the fact that changes to water yield in a watershed is highly variable. It is known that as harvesting and road building increase, higher peak and low flows tend to occur. It is also known that the Forest Plan sets the threshold for concern at 20 percent harvesting over a 30-year period. Water yield analysis for the Tuxekan Project is based on this threshold.

Water Yield Direct, Indirect and Cumulative Effects

The analysis area for cumulative effects to water yield is the 17,730 acre Tuxekan Project Area and the 21 individual coastal or karst defined watersheds. This was chosen because Tuxekan Island is the project area as well as the cumulative watershed effects area. The temporal boundaries go back to the start of timber harvest and road building on the island and go until 2012, when all proposed projects are expected to be implemented.

Water Yield Direct, Indirect and Cumulative Effects Specific to Alternative 1 – No Action

Alternative 1 would not further impact water yield as it is the no action alternative. By not implementing the Tuxekan Project, regrowth after harvesting would continue in project area watersheds, moving vegetation and, subsequently, hydrologic function to pre-harvest conditions.

Water Yield Direct, Indirect and Cumulative Effects Common to Alternatives 2, 3, 4, and 5

As mentioned, water yield is impacted by changes in vegetation. This includes the continuing growth, regrowth after harvesting, or removal of vegetation through timber harvesting and road building. Table 3-23 illustrates the acres and percent of each watershed that would be scheduled for harvesting and road building activity within the Tuxekan Project under Alternatives 2, 3, 4, and 5.

Table 3-23. Percent of the Tuxekan project area watersheds disturbed by timber harvesting since 1976 and existing and decommissioned roads including implementation of the King Tux Pre Commercial Thinning Project and the Tuxekan Project

Watershed Number	Alt 2	Alt 3	Alt 4	Alt 5
1	36	36	32	36
2	23	23	23	23
3	38	38	34	38
4	7	7	7	7
5	28	28	27	27
6	1	5	3	5
7	7	13	10	12
8	3	3	3	3
9	7	7	7	7
10	10	12	12	12
11	6	6	6	6
12	11	13	14	12
13	0	0	0	0
14	10	10	10	10
15	5	5	5	5
16	8	8	8	8
17	7	8	8	7
18	4	10	10	10
19	13	13	13	13
20	9	9	9	9
21	11	11	11	11

Table 3-23 shows that should all future implementation take place in year 2006, four of the watersheds would exceed the 20 percent threshold of concern for all action alternatives. The four watersheds that are currently over the 20 percent threshold of concern would remain over the threshold of concern after project implementation. These watersheds include 1, 2, 3, and 5. Watershed 1 would be raised from 29 percent (existing condition) disturbance to 32 percent in Alternative 4 and 36 percent in Alternatives 2, 3, and 5. Watershed 2 would actually see a reduction in disturbance over the past 30 years even after implementation of the future projects (King Tux and Tuxekan projects). Watershed 2 would be reduced from 24 percent (existing condition) to 23 percent disturbance in all action alternatives. This is due to the maturity of second growth stands over 30 years of age within the watershed. Watershed 3 would be raised from 32 percent (existing condition) disturbance to 34 percent in Alternative 4 and 38 percent in Alternatives 2, 3, and 5. Finally, Watershed 5 would see an increase from 25 percent (existing condition) to 27 percent in Alternatives 4 and 5 while seeing an increase to 28 percent in Alternatives 2 and 3.

Table 3-24 shows total land disturbance by project area watersheds from timber harvesting from 1981 through 2011 and all existing and decommissioned roads following implementation of the Tuxekan Project and the King Tux Pre Commercial Thinning Project. Table 3-24 assumes that all harvesting and road building would be complete by 2011. This represents disturbance conditions when all 21 watersheds within the Tuxekan Project Area would be under the 20 percent threshold of concern for water yield.

Table 3-24 shows that once implementation is complete in 2011, all project area watersheds would be below the 20 percent threshold of concern. The scheduled project completion date is 2012. If no action is taken (Alternative 1), Watersheds 1 and 3 would go below the 20 percent threshold of concern in 2011, the same year the watersheds would have recovered with implementation of the Tuxekan and King Tux projects. Watershed 2 would go below the 20 percent threshold of concern in 2010, the same year the watershed would have recovered with implementation of the Tuxekan and King Tux projects. Watershed 5 would go below the 20 percent threshold of concern for water yield in 2010 provided no action is taken. It would recover to below 20 percent in 2011 after implementation of the Tuxekan and King Tux projects.

In summary, four watersheds are currently over the 20 percent threshold of concern for water yield. These watersheds are 1, 2, 3, and 5. No matter whether the King Tux and Tuxekan Projects are implemented, three of the four watersheds would recover to below 20 percent disturbance in the same year as when the no action alternative would recover. Watershed 5 would recover 1 year faster should no harvest occur. Essentially, the 4 watersheds currently over the threshold of concern for water yield would recover at approximately the same time no matter if the Tuxekan and King Tux Projects are implemented or not. A significant change to water yield is not anticipated no matter which alternative is selected.

Table 3-24. Percent of the Tuxekan project area watersheds disturbed by timber harvesting since 1981 and existing and decommissioned roads including implementation of the King Tux Pre Commercial Thinning Project and the Tuxekan Project[a]

Watershed Number	Alt 2	Alt 3	Alt 4	Alt 5
1	13	10	13	13
2	12	12	12	12
3	15	11	15	15
4	6	6	6	6
5	13	12	12	12
6	2	6	5	6
7	10	16	13	15
8	4	4	4	4
9	8	8	8	8
10	13	13	13	13
11	7	7	7	7
12	4	5	3	4
13	0	0	0	0
14	0	0	0	0
15	7	7	7	7
16	10	10	10	10
17	9	7	9	9
18	10	10	10	10
19	14	14	14	14
20	12	12	12	12
21	11	11	11	11

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

[a] Measure 1H2: Within the project area, the total percent of each project area watershed harvested during the past 30 years and existing and proposed roads, including the timber harvesting and road building acreage for this proposed sale.

Sediment Yield Affected Environment

The “Soils” section of this report, under “Soil Surface and Mass Erosion-Affected Environment” discusses factors that influence soil erosion on Tuxekan Island. In summary, erosion occurs from natural causes such as mass movement and windthrow and through land management activities such as road building and timber harvest. Skid trails, roads, culverts, rock quarries, and landings are the primary surface erosion producers from land management activities. Windthrow and mass movement events are the primary surface erosion producers from natural events. Land management activities, such as road building and timber harvest, can also increase the risk of typical natural events (i.e. mass wasting).

Erosion turns into sediment when carried away by water. Waters that have the ability to transport sediment include surface water, streams, and subsurface karst pathways. When sediment is routed to stream channels or karst features, the beneficial uses of water can be affected. As stream channel size and shape have evolved to carry the historical sediment load, large increases in sediment yielded to a stream or river system may exceed the stream's ability to transport the load (Dunne and Leopold 1978). As a result, sediment deposition occurs in the stream channel, especially in low-gradient sections of a stream, as point bars and mid-channel bars. This leads to a wider, shallower, less stable channel than pre-deposition conditions, and can have a detrimental effect to the downstream fisheries resource by clogging spawning gravels. Increased sedimentation also impacts cave and karst resources, macro-invertebrates, and other aquatic organisms. For discussions regarding effects to karst and cave resources see the “Karst Sediment Yield” section in the Karst Resources report of this document. Bank erosion may also be increased, thus adding even more sediment to the load of the stream.

The largest contributor of sediment within the Tuxekan Project Area is roads. Sediment from roads comes from surface fines directly from the road prism; landslides caused by past road placement or improper road design; road cut and fill slopes; and plugged culverts; as well as from culvert fill slopes. On Tuxekan Island, existing roads have a greater impact on sediment yield than decommissioned roads. Decommissioned roads are absent of culverts and drainage structures that can potentially fail and add sediment to rivers and streams.

Table 3-16 shows the miles of existing and decommissioned roads within each of the Tuxekan Project Area watersheds. There are 60.9 miles of existing and decommissioned roads in the project area. Table 3-17 shows the acres of existing and decommissioned roads within RMAs in each of the 21 project area watersheds. There are 26.8 miles of existing and decommissioned roads within RMAs in the project area. Roads that are close to or cross streams, such as those located within RMAs are the largest contributors of sediment to streams.

Timber harvesting activity has the potential to produce sediment to streams as well. Past harvesting is discussed earlier in the “General Affected Environment” portion of this hydrology section. Both overall past harvesting and harvesting within RMAs is displayed in Table 3-13 and Table 3-15 respectively. The closer the timber harvesting to streams the more potential for sediment yield increases.

Mass movement is another contributor of sediment to streams in Southeast Alaska. Mass movement can occur naturally or be triggered by land management activities such as road building and timber harvesting. Most of the Tuxekan Project Area is mapped as low risk for mass movement. The most prominent mass movement process is slow soil creep, common to steeper soil covered slopes. Some moderate risk mass movement does exist though limited in extent. No high-risk Mass Movement Index IV soils exist within the project area.

Limited mass wasting does occur within the project area. The “Soils” section of Chapter 3 states that field observations found infrequent small (less than 5 cubic meter) shallow landslides, though infrequent. These failures were related to high slope angle, poorly drained glacial soils, and relatively saturated soil conditions. Failures also occurred where streams have eroded toe-slopes.

For further information on mass movement potential within the project area, please see the “Soils” section of Chapter 3.

Sediment Yield Direct/Indirect Effects Specific to Alternative 1 – No Action

No sediment would be generated from Alternative 1 as it is the no action alternative.

Sediment Yield Direct/Indirect Effects Common to Alternatives 2, 3, 4, and 5

Because of the general unreliability of sediment models in Southeast Alaska, analysis for direct/indirect effects for sediment yield uses a variety of techniques. For the Tuxekan Project sediment yield analysis, alternatives cannot be compared using strictly a quantitative or qualitative approach. Quantitative data is used where possible, and literature and field observation is used to further strengthen the analysis.

Sediment from roads: Road building can be the most significant cause of mass erosion and surface erosion in a wildland watershed setting (Grigal 2000, Trombulak and Frissell 2000). Roads create permanent ground disturbance, trigger mass wasting, clear vegetation, and create additional drainage pathways for sediment to enter rivers, streams, or karst systems.

Potential sediment yield increase from roads was analyzed using several methods. The first method took the miles of constructed road and combined the results with slope class. This metric is a good predictor of potential erosion among alternatives. The amount of road construction planned in the Tuxekan Project ranges from 6.0 to 9.6 miles depending on the Alternative selected. Analysis showed that most construction would occur on slopes less than 30 percent, though small sections on steeper slopes (30-67 percent) comprise 0.8 miles of road construction for Alternative 2, 1.7 miles for Alternative 3, 1.0 miles for Alternative 4, and 1.4 miles of new road construction for Alternative 5. No roads are proposed on slopes in excess of 67 percent, which meets Forest Plan Standards and Guidelines. Because of the low topographic relief of the landscape and the shallow soils on steep slopes, road construction is not expected to trigger mass movement activity for any of the action alternatives.

Table 3-20 shows the acres of road construction proposed within RMAs for Alternatives 2, 3, 4, and 5. Alternatives 2 and 4 propose 1.0 acres, Alternative 3 proposes 1.3 acres, and Alternative 5 proposes 0.9 acres. There are 1,974 acres of RMA within the Tuxekan Project Area. Less than 0.1 percent of the total RMA in the project area would be disturbed by implementation of any of the action alternatives. For this reason, roads within RMAs would produce negligible sediment to project area rivers and streams.

Stream crossings are proposed for all action alternatives. Sediment would be produced where road/stream interaction takes place. Culvert and bridge installation requires disturbance of stream channels and stream crossings are main points of entry for sediment from roads. Table 3-25 lists the total number of stream crossings for each action alternative in the project area watersheds.

Table 3-25. Number of stream crossings proposed for each action alternative in the Tuxekan project area watersheds

Watershed	# of stream crossings proposed for Alternative 2	# of stream crossings proposed for Alternative 3	# of stream crossings proposed for Alternative 4	# of stream crossings proposed for Alternative 5
1-2	0	0	0	0
3	2	2	1	2
4	2	2	2	2
5	0	0	0	0
6	0	3	3	3
5-17	0	0	0	0
18	2	2	2	2
19	1	1	1	1
20-21	0	0	0	0
Total	**7**	**10**	**9**	**10**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

The Road Water Erosion Prediction Project (Road WEPP) was used to estimate the amount of sediment expected to enter streams at individual stream crossings proposed for Alternatives 2, 3, 4, and 5 of the Tuxekan Project. Data parameters included: local climate data, soil texture, road design, road gradient, length, and width, fill gradient and length, buffer gradient and length, road surface, and traffic level. The dominant soil texture used was silt loam, which is the most prevalent soil texture on the Tuxekan Island GIS soil layer. The slope characteristics were developed from USGS 7.5 minute quadrangles. Other assumptions made during the modeling process are described here:

- The climate data from the Klawock, Alaska NOAA station was modified as the climate to model the precipitation events within the project area.
- Road design was assumed to be “Insloped, bare ditch”. Roads on Tuxekan Island are generally built with a crown prism. Insloped, bare ditch” represents the closest choice to a crowned road prism in the Road WEPP Model.
- Road surface was assumed to be “graveled” and traffic level “low”.[2]
- The time period modeled was for 30 years. Therefore, the reported soil erosion rates can be expected to be the maximum probable rate associated with a 25-year return interval storm.

[2] High traffic is generally associated with a timber sale, hauling numerous loads of logs over the road, or roads that receive considerable traffic during much of the year. Low traffic roads are roads with administrative or light recreational use during dry weather. No traffic roads are roads with restricted or no access, and have vegetation growing on more than half of the road surface. Low traffic was used because logging roads in SE Alaska hold up much better than roads where this model was tested (in the lower 48). Low was also chosen because, after logging operations stop on Tuxekan Island, these road will rarely get used, and, during logging, the roads will hold up much better than the roads where the model was tested. You rarely see fines coming off roads in SE Alaska due to the gravel component in them. The low determination was based on field verification.

The Road WEPP Model is accurate to plus or minus 50 percent. The Road WEPP Model is a tool for comparing alternatives and giving an estimate to the amount of sediment that would reach project area streams.

Results from Road WEPP indicate that approximately 1.6 tons of sediment would reach rivers and streams per stream crossing annually. This means that Alternative 2 would produce approximately 11.2 tons of sediment to streams annually from crossings, Alternative 4 would produce approximately 14.4 tons annually, and Alternatives 3 and 5 approximately 16.0 tons annually.

Sediment from harvesting: Timber harvesting increases sediment yield potential by removing forest canopy and compacting soils by building skid trails and landings and yarding trees. Table 3-26 shows the acres of timber harvesting proposed for each action alternative.

Table 3-26. Proposed timber harvesting acres within Tuxekan Project Area watersheds under Alternatives 2, 3, 4, and 5

Watershed	Alt 2 proposed harvest acres	Alt 3 proposed harvest acres	Alt 4 proposed harvest acres	Alt 5 proposed harvest acres
1	94	94	59	94
2	2	2	2	2
3	50	50	29	50
4	6	6	3	6
5	147	157	91	22
6	0	70	45	70
7	3	38	19	36
8	0	5	4	5
9	40	40	40	40
10	5	5	5	5
11	0	0	0	0
12	15	24	10	15
13- 15	0	0	0	0
16	1	1	0	1
17	4	4	0	4
18	48	48	48	48
19	27	27	27	27
20 & 21	0	0	0	0
Total	**442**	**571**	**382**	**425**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Alternative 3 would harvest the most timber of any of the action alternatives at 570 acres. Alternative 5 would harvest the second highest amount of timber at 523 acres, followed by Alternative 2 at 441 acres and Alternative 4 at 382 acres. No harvest would occur in RMAs and within one site potential tree length from the outside edge of the RMA.

The majority of the timber harvesting would occur on land with low mass movement potential and moderate slopes. The Tuxekan Project was designed to limit steep harvest areas to less than an acre for all units except two. These are units 560-412 and 587.2-414. Approximately four acres of slopes greater than 72 percent are planned for harvesting in Alternatives 2 and 4 and six acres under Alternative 3 and 5. These steep slopes are proposed for harvest because field review showed no instability with these units. These slopes have shallow, well-drained soils, which are not conducive to mass movement. In addition to timber harvesting on slopes greater than 72 percent, less than 1.0 acre of land greater than 72 percent would be used as yarding corridors for all alternatives. Geologically, these slopes are bedrock with shallow soils. Yarding operations would not increase the risk for soil movement on these slopes.

Sediment from mass movement

As stated previously, most of the Tuxekan Project Area is mapped as low risk for mass movement. The topography of Tuxekan Island does not favor mass erosion since soils are thin on steep slopes. The most prominent mass movement process is slow soil creep, common to steeper soil covered slopes. Some moderate risk mass movement does exist though limited in extent. No high-risk Mass Movement Index IV soils exist within the project area. No roads would be built on slopes greater than 67 percent and at most, eight acres of timber harvesting would occur on slopes greater than 72 percent and 1.0 acres of slopes greater than 72 percent would be used for yarding corridors. Surface erosion on these slopes over 72 percent is not likely since these areas have thin well-drained soils over bedrock. As a result, a negligible increase in potential sediment supply is expected.

Sediment from increased water yield

As mentioned in the water yield section of this analysis, timber harvesting and road building remove vegetation, potentially impacting flow dynamics within rivers and streams. Increases in stream flow can potentially accelerate stream bank erosion in alluvial channels as the channel adjusts to new flow patterns. If the water yield increase is large enough to cause a change in flow regime, alluvial channels adjusting to changes in water yield would contribute additional sediment to the aquatic environment. The proposed activities are not likely to affect water yield, thus not impacting sediment yield.

Sediment Yield Direct / Indirect Effects Summary

Regardless of the alternative selected, minimal increases in sediment yield to Tuxekan Project Area rivers and streams would be realized. Impacts from sediment are not be expected to produce effects to water quality, fish habitat, and cave and karst resources that would significantly alter existing condition.

Newly constructed road/stream crossing areas would contribute sediment to rivers and streams annually as long as the road prism exists. The majority of roads would be built on slopes less than 30 percent. No roads would be built on slopes over 67 percent. It is not anticipated that roads would trigger mass movement events, as the Tuxekan Project Area is an area of low topographic relief. Where steep slopes do occur in the project area, thin well-drained soils are prevalent-limiting the ability for large mass wasting events from roads.

Less than 0.1 percent of the project area RMAs would be disturbed by road building. No timber harvesting would occur within RMAs. This percentage represents a small disturbance, and negligible effects are anticipated.

Seven to ten stream crossings would be constructed, depending on the alternative selected for the Tuxekan Project. Road WEPP estimates that these crossings would produce between 11.2 and 16.0 tons of sediment annually to project area rivers and streams depending on the alternative selected.

Between 382 and 570 acres of timber harvesting would occur depending on which action alternative is selected. As mentioned, no harvesting would occur in RMAs and one potential site tree from the edge of the RMA. This would insure that erosion caused by harvesting activity would be buffered before reaching stream channels. At most, eight acres of timber harvesting and one acre of yarding would occur on slopes greater than 72 percent. Field reconnaissance verified that these are areas of thin well-drained soils over bedrock, making the possibility for mass wasting events is negligible.

The Tuxekan Project would slightly alter water yield dynamics. Watersheds currently above the 20 percent threshold of concern would recover at essentially the same point in time no matter if the Tuxekan Project is implemented or not (see “Water Yield” section). Therefore, sediment yield increases from changes in water yield would be negligible or nonexistent.

Sediment Yield Cumulative Effects

The analysis area for cumulative effects for sediment yield is the 17,730 acre Tuxekan Project Area. This was chosen because Tuxekan Island is the project area as well as the cumulative watershed effects area. The temporal boundaries go back to the start of timber harvest and road building on the island and go until 2012, when all proposed projects are expected to be implemented

From a sediment yield cumulative effects standpoint, two projects are scheduled for implementation within the next 5 years. These are the ongoing King Tux Pre Commercial Thinning Project and the Tuxekan Project.

No road building or ground disturbance would occur with implementation of the King Tux Pre Commercial Thinning Project. The project would be completed by sawyers walking through timber harvest units and hand thinning existing second growth to a spacing of 12 by 12 feet or 14 by 14 feet. No mechanical equipment would be used except chain saws. Harvested trees would be left on site. Little to no ground disturbance is expected from this project.

As for the Tuxekan Project, effects presented in the “Sediment Yield Direct/Indirect Effects” section above would be added to the current condition.

After implementation of the Tuxekan Project, road density for the project area would increase from the current 2.2 miles of road/square miles of drainage to 2.4 miles of road/square miles of drainage for Alternatives 2 and 4, and 2.5 miles of road/square mile of drainage for Alternatives 3 and 5. None of these new density values represents increases of concern in terms of sediment yield.

As stated above, the majority of roads built for the Tuxekan Project would be built on slopes less than 30 percent. No roads would be built on slopes over 67 percent. It is not anticipated

that roads would trigger mass movement events, as the Tuxekan Project Area is an area of low topographic relief with thin well-drained soils over bedrock.

The majority of the timber harvesting would occur on land with low mass movement potential. Approximately six acres of slopes greater than 72 percent are planned for harvesting in Alternative 2, eight acres under Alternative 3, five acres under Alternative 4, and eight acres under Alternative 5. Less than one acre of slopes greater than 72 percent would be used as a yarding corridor. These slopes would be harvested or used for yarding because field review showed no instability with these units. These slopes have shallow soils over bedrock, which is not conducive to mass movement.

Further, less than 0.1 percent of the RMAs within the project area would be disturbed by timber harvesting and road building. This disturbance is negligible.

There would be between seven to ten additional stream crossings constructed within the project area. At most, an additional 16.0 tons of sediment would be added to project area rivers and streams annually from these crossings.

Analysis shows that none of the watersheds would be above the threshold of concern for water yield assuming the project is completed in 2011. Therefore, sediment yield increases from changes in water yield would not be realized.

Sediment yield cumulative effects summary

The King Tux Pre Commercial Thinning Project and the Tuxekan Project, when added to existing condition, would increase sediment yield, but to rates that are negligible and hard to detect. The majority of the sediment yield increase from these projects would be from stream crossings.

None of the watersheds where management activity is planned would exceed the threshold of concern for water yield, assuming the project is completed by year 2011. It is likely that past activity has already impacted the sediment yield of the project area. The addition of both the King Tux Pre Commercial Thinning Project and the Tuxekan Project would not further impact sediment yield through increases in water yield dynamics.

Karst

Basic project area information and units of measure for direct and indirect effects are summarized below in Table 3-27, Table 3-28, and Table 3-29. Per Forest Plan direction, all carbonate is considered karst (1997a). Carbonate related numbers summarized in the Direct/Indirect and Cumulative Effects analysis tables are different between the DEIS and FEIS as an updated geology layer was used in preparation of the FEIS.

To further evaluate potential project-related effects to karst, the Forest Geologist and additional Forest Service personnel conducted additional fieldwork in June of 2005 by. The results were then summarized in a report (Baichtal 2005a-d, and North 2005c and d) and integrated into the analysis and interpretation of potential project impacts on karst. As a result, a number of the proposed road locations were changed to avoid areas of high vulnerability karst (Table 3-27); Appendices 1 –ROD Unit Cards and 2 - ROD Road Cards). While the road relocations decreased the amount of proposed road construction on high vulnerability karst, the road relocations increased NFS road between 0.7 – 1.0 mile (depending on alternative) and decreased the amount of temporary road of 0.6 – 1.0 miles.

Table 3-27. NFS Road Location Modifications Between DEIS and FEIS

Road Number	Included in Alternative	Miles of Road		
		DEIS Location	FEIS Location	Total Change in Individual Road Miles
1460015	**2, 3, 4, 5**	0.2	0.2	**0.0**
1460900	**2, 3, 4, 5**	0.2	0.2	**0.0**
1470000	**2, 3, 4, 5**	1.1	1.8	**+0.7**
1470131	**2, 3, 4, 5**	0.2	0.2	**0.0**
1470320	**3, 4, 5**	0.6	0.9	**+ 0.3**
1470330	**3, 5**	0.4	0.4	**0.0**

Table 3-28 summarizes the analysis of results used to compare effects to karst for Issue 1. Additional information regarding the karst analysis is provided below. For the complete karst analysis, please refer to the specialist's report for karst located in the planning record.

Table 3-28. Comparison of Issue 1 Hydrology measures by alternative

Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
1K1 Acres of proposed single-tree selection (STS) on carbonate.	0	37	37	56	37
1K2 Acres of proposed clearcut with reserves (CCR) on carbonate.	0	319	447	255	401
1K3 Acres of harvesting proposed on carbonate.	0	356	484	311	438
1K4 Percent increase of harvest acres on carbonate less than 30 years old by 2012	0	18	27	16	22
1K5 Miles of proposed NFS road on high vulnerability karst	0	0	0	0	0
1K6 Miles of proposed temporary road on high vulnerability karst	0	0	0	0	0
1K7 Miles of proposed temporary and NFS road on carbonate	0.0	5.8	9.2	6.0	8.4
1K8 Cumulative total number of road miles on carbonate (existing, decommissioned, and proposed)	56.3	62.1	65.5	62.3	64.7
1K9 Percent increase in miles of road on carbonate	0.0	10.3	16.3	10.7	14.9

The analysis area (the 17,730-acre Tuxekan Island) used for direct, indirect, and cumulative effects for karst resources, is the same as for the hydrology resource (see *Hydrology, General Affected Environment*, pp. 3-16 through 3-19 and Figure 3-3). It should be noted that the watershed boundaries defined in Figure 3-3 have been modified from conventionally defined hydrologic unit codes (HUC), which are based on topography, to reflect the influence of karst-related groundwater hydrology. The justification for modifying these HUC boundaries is discussed below under "Known Karst Resources within the project area".

Karst Affected Environment

Methods of Analysis

A variety of methods was used to analyze potential project-related effects to karst resources. Existing data resources were reviewed prior to field work conducted by URS Corporation in 2000, including the Soil Resource Inventory Report for the Ketchikan Area (USDA FS 1994a), the Karst Vulnerability Report for Tuxekan Island (Harza 1995), as well as other maps and reports. Black and white aerial photos taken in 2000 as part of a LIDAR survey provided recent photo documentation of the project area. LIDAR is a laser-based technique for obtaining detailed topographic information. In addition to conventional aerial photographic interpretation, LIDAR was used to assist in aerial photographic interpretation. LIDAR is significantly more accurate in defining potential karst features and drainages. This information was then used by the interdisciplinary team to help determine which units needed to be field reviewed. URS conducted a field review of units in the spring and summer of 2000. Personnel trained in the identification of karst topography conducted field verification.

The data collected by URS during the field survey was used to generate slope hazard and karst/feature/karst vulnerability layers in the GIS database, to develop karst vulnerability maps for the project. The resultant data, analysis, and interpretation were then summarized in the Soils, Geology, Mineral, and wetlands Resources Inventory Report for the Tuxekan Island Timber Sale (URS 2001).

The 2001 karst assessment conducted by URS identified karst features and their vulnerability; and conducted a dye injection study to help evaluate and delineate the associated hydrologic system, including groundwater, and catchment areas that contribute water to one or more karst related hydrologic systems. Dye injection studies are a fundamental tool used to understand groundwater conditions in karst areas (Harza 1995). The basic approach consists of introducing small amounts of a fluorescent tracer dye into insurgences or where water goes underground into the karst system. Potentially relevant springs, caves, and surface streams (resurgences) are then sampled to determine the presence or absence of the introduced dye. This information is important as waters originating in one watershed may actually discharge at the bottom of another watershed, as a result of going "underground". The results of this study, in association with the mapping of surface water pathways, and topographic boundaries were used to adjust the existing hydrologic unit code (HUC) boundaries, or watersheds. These adjustments were made to account for the subsurface pathways defined by the dye studies. As a result, all watershed boundaries shown in this EIS reflect current knowledge of karst hydrologic unit boundaries, and may cross-topographic divides.

Karst features identified within the project area include caves, insurgences, resurgences, sinkholes, collapse channels, and basins, areas of epikarst knobs, grikes, and solution rilling. The data collected on these features was summarized on karst feature forms, karst classification forms, and in field summary reports (URS 2001). The Forest Service found additional features in 2005 and some initial vulnerability ratings were re-classified. This information is summarized in Appendix I. Associated field reports and personal communications are found in the project file.

Aerial photographic interpretation and field reconnaissance indicate that past timber harvesting and road building has resulted in modifications to the hydrologic regime of the

karst ecosystem within the project area. Observed changes include sediment deposits; the infilling of, and or blocking of, cave entrances by logging slash, sediment, and debris; waterline marks, and tannin staining and dissolution of fragile cave formations. Evidence that flooding occurred in passages that have not experienced peak flows for centuries, was noted. The hydrologic changes are a function of alterations to the amount and timing of peak surface flows and flood regimes. In addition, flow volume has been increased where surface runoff from roads was diverted into karst features (USDA FS 1997b; USDA FS 1993; Baichtal and Swanston 1996).

Geologic Setting

Tuxekan is part of the Alexander Archipelago, which is only one of five sub continental blocks of geology in Southeast Alaska. The bedrock geology on Tuxekan is summarized in Figure 3-5. The geology is dominated by shallow marine limestone. Silurian age sandstones, and conglomerates, Silurian/Devonian greywackes, Silurian greywackes and unconsolidated Quaternary glacial deposits are also present. The Quaternary deposits are found mainly in low-lying areas of the project area, with some occurrence at higher elevations.

These rocks are part of the Alexander Terrane, which is one of several sub continental blocks found in Southeast Alaska. As the Alexander Terrane was accreted on to the existing mainland, these rocks were deformed, resulting in regional metamorphism and faulting of the rocks. At the larger inter-island/mountain block scale; first-order, or major faults; trend northwest-southeast, and are intersected by second-order faults; which trend north-south. As a result, the rocks of the Alexander Terrane are divided into large blocks (Figure 3-5, Coney et al. 1980).

The term “karst” is defined as an area of limestone, or other soluble rock, in which landforms are primarily solutional in origin. Drainage is underground through fissures that have been enlarged by solution (Ford and Williams 1989). It is the repetition of the large-scale fault pattern at a smaller scale that defines the individual karst landscapes (Baichtal 1995a). A second repetition of this dominant fault pattern at the local scale includes smaller scale faults, joints, and fractures that appear to control the location of individual karst features (Aley et al. 1993; Baichtal and Swanston 1996).

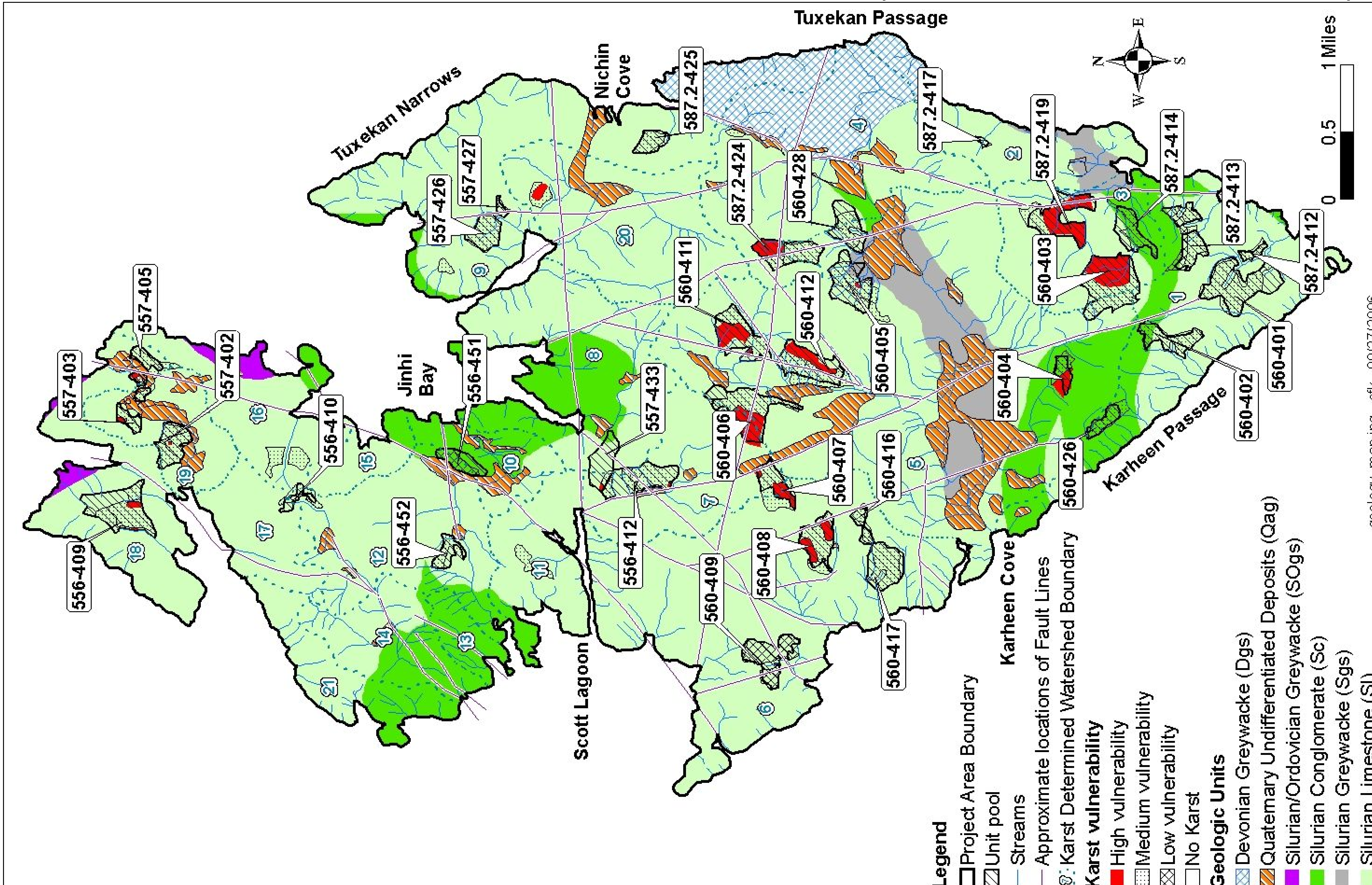

Figure 3-5. Geologic map of the Tuxekan Project Area

Factors Influencing Karst Formation

Baichtal, (1995a) lists six key factors that control the development of karst. These are: 1) purity of the carbonate rock; 2) the structural components of the bedrock; 3) the proximity of carbonates to peatlands and other forest vegetation; 4) the precipitation and temperature that influences weathering rates and solution activity; 5) occurrence of igneous intrusions[3]; and 6) modification of surface topography and drainage by glacial activity.

Karst system development requires greater than 70 percent calcium carbonate (CaCO3) (USDA FS 1993). Sixty-seven limestone and marble samples were collected from nearby northern Prince of Wales and surrounding islands. Chemical analysis showed that CaCO3 concentrations ranged from 91.47-99.46 percent, with an average concentration of 97.65 (USDA FS 1997, Mass et al. 1992). The localized fault systems on Tuxekan define zones where the rock has been fractured, jointed, and sheared, providing areas where chemical weathering is enhanced because of the structural geology concentrating groundwater flow.

In Southeast Alaska, peatlands have formed atop poorly drained non-carbonate rocks and compacted glacial deposits, some of which cap collapsed karst features. Surface waters originating from these poorly drained areas seldom flow more than a few yards onto carbonate substrate before diving below the ground, down vertical shafts or into cave entrances (Baichtal 1993a, 1995b; Brock and others 1995). The highly acidic waters flowing from the sphagnum-dominated peatlands (pH ranges from 2.4 to 5.8) accelerate cave and karst development. Because the pH of waters flowing from the cave systems range from 7.5 to 9.0 (Aley and others 1993), the buffering capabilities of the pure carbonates is evident. Rainfall within the Tongass varies from 60-250 inches a year. Runoff in karst areas of Southeast Alaska, which is typically 8-16 times higher than other North American karst areas, reflects the high precipitation regime of the area. As a result, karst development, due to solution of carbonate rocks, is 4-8 times faster in Southeast Alaska (USDA FS 1997c). Ford and Williams (1994) note that the development of karst landscapes is enhanced in alpine and cold temperate regions with high precipitation and runoff. All of these factors are present on Tuxekan Island. In addition, igneous intrusions have been noted to block groundwater flow as well as alter the carbonate rock through thermal metamorphism.

Repeated glaciation in Southeast Alaska has strongly influenced the character of these karst landscapes. It is during these glacial advances that hardpans developed which now play a role in the current karst landscape. Along with the hardpans, epikarst also developed, which is the surface of the karst. It consists of an intensely dissolved veneer consisting of an intricate network of intersecting dissolution-widen fissures, cavities, and tubes (USDA FS 1997c). Field evidence indicates that glaciation has modified pre-existing karst landscapes by eroding features, collapsing some, eroding into others, and choking others with glacial deposits. Epikarst thickness is a function of glacial history and plays a key role in moving water, nutrients, organic matter, and soil from surface environment and rooting zone into the subsurface environment where it is moved to other environs and watersheds by groundwater flow (USDA FS 1977c; Baichtal, Swanston and Archie 1995).

Significance of Cave and Karst Resources

Within the Forest Service, direction for management of the karst and cave resources can be found in Forest Service Manual (FSM) 2880 and 2356. The major focus and intent of the

[3] Geologic terms can be found in the glossary.

Tongass National Forest karst management strategy is to identify and protect karst systems and the caves and associated resources contained within, as per the requirements of the Federal Cave Resources Protection Act of 1988 (FCRPA). The FCRPA is the primary U.S. law affecting caves. It requires protection of significant caves on Federal lands. A cave must possess one or more of the criteria outlined in 36 CFR Part 290.3 to be determined "significant". Though "non-significant" caves may exist on the Forest, most meet the criteria for "significant". The intent of this act is to protect cave resources not karst resources. However, it is important to recognize that caves and associated features and resources are an integral part of the karst landscape. Karst must be managed as an ecological unit to ensure protection of the associated cave resources. In practice, the Forest gives equal protection to important karst features, sinking or losing streams, springs, and caves.

The tie between karst ecosystems and forest productivity has been well-documented (USDA FS 1997b and c; USDA FS 1993; Baichtal and Swanston 1995; Bryant et al. 1998; Baichtal, Swanston and Archie 1995). Preliminary studies indicate that aquatic habitat associated with karst landscapes may be 8-10 times more productive than adjacent non-karst aquatic habitats. Forest productivity is also higher due to nutrient rich soils, well-developed subsurface drainage, and improved wind-firmness due to dissected bedrock. Caves are known to provide valuable habitat for many differing species of wildlife (USDA FS 1997c).

These karst areas are most comparable to those of karst lands found on Vancouver Island and the Queen Charlotte Islands of British Columbia, Canada, portions of Patagonia (Chile), Tasmania, and the west coast of the South Island of New Zealand. All of these areas have very steep surface slopes and subsurface hydraulic gradients, and very high levels of rainfall. These characteristics put them among the most dynamic karst terrains on earth, evolving and changing more rapidly and abruptly than karst in more moderate settings. The Karst Panel Report (Aley *et al*, *1993*) found the karst lands of the Tongass to be of national and international significance for a variety of reasons. The Karst Review Panel in the summer of 2002 re-confirmed these findings (Griffiths *et al*., 2002). Both of these Panels consisted of world-renowned karst experts with a breadth of karst resource backgrounds and a wide variety of international exposure to karst areas and management considerations.

Known Karst Resources within the Project Area

Karst topography is abundant across the project area and is present in varying degrees of development (Figure 3-6 and Figure 3-7). Approximately 75 percent of the project area, or 13,351 acres, is underlain by limestone or limestone conglomerate, which is susceptible to karst system development.

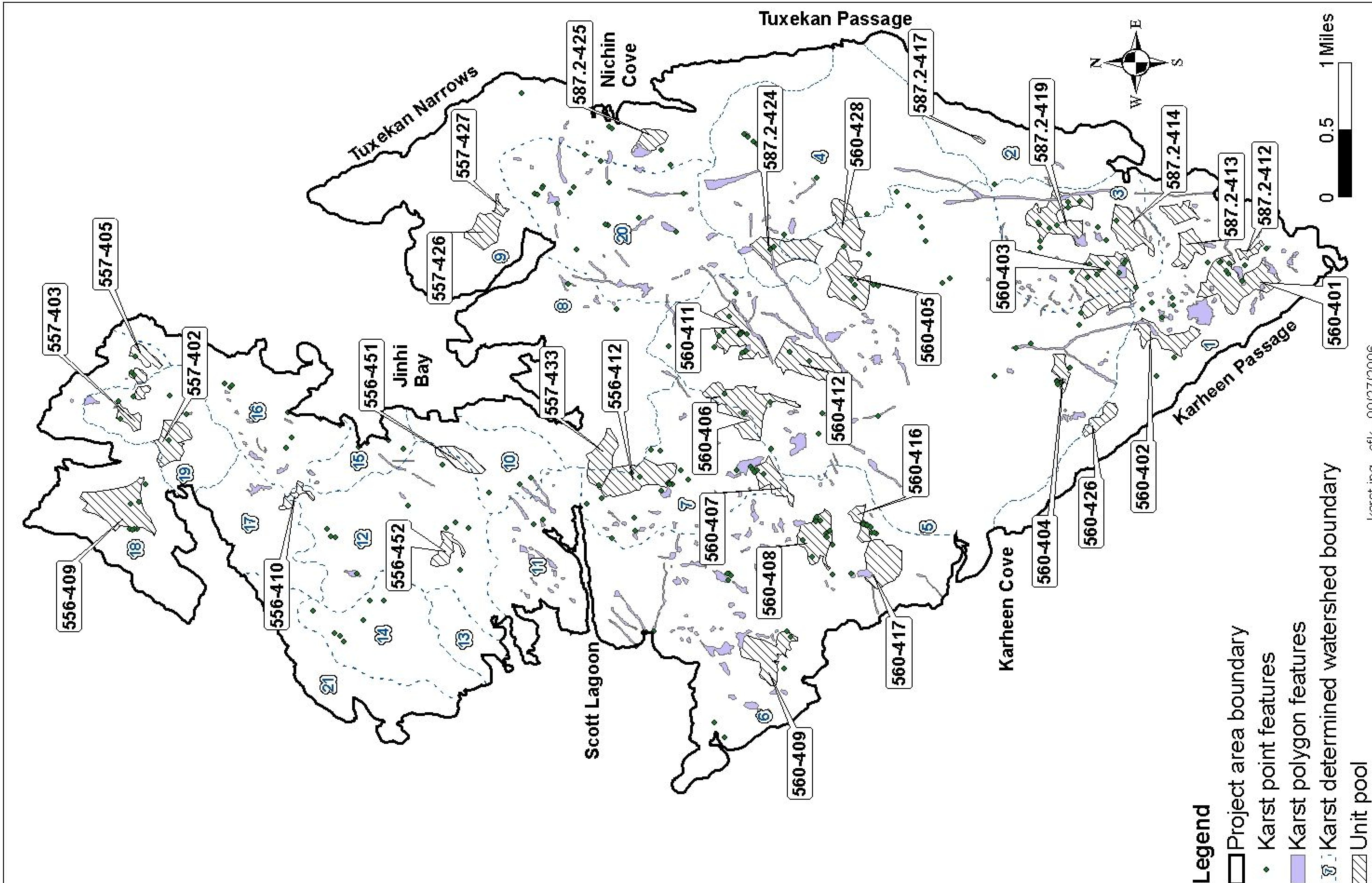

Figure 3-6. Location of karst features within the proposed Tuxekan Project Area

Vulnerability Levels

Vulnerability mapping is a land management tool that utilizes the fact that some portions of a karst landscape are potentially subject to appreciably greater resource damage and contamination risk than others. Variations in vulnerability are a function of the extent of karst development at the rock-soil interface (epikarst), the openness of the karst system, and the resources that benefit from the karst hydrologic system. Tuxekan karst resources, and their vulnerability, were mapped using a modified methodology that was originally based on a strategy devised by Aley et al. (1993) and the Forest Service (USDA 1994). For the Tuxekan project, the methodology was modified using the Tongass Plan Implementation Team draft clarification paper for karst resources (1999), along with further modifications provided during 2000 by the Forest Service, and the 1997 standards and guidelines from the Forest Plan.

Karst vulnerability within proposed units was mapped as low, moderate, or high depending on the connectivity to subsurface flow and the overall openness of the karst (Figure 3-7) (URS 2001).

Low Vulnerability

Low vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are not likely to be appreciably greater than those posed by similar activities on non-carbonate substrate are. The following is a generalized characterization of these lands:

These are areas underlain by carbonate bedrock that are moderately-well to well drained, most commonly internally drained but surface streams may be present. Generally, these areas have been greatly modified by glaciation, and a deep (greater than 40 inch deep) covering of glacial till or mineral soil, and little or no epikarst showing at the surface. The epikarst may be buried and/or ground off, depending on the intensity of glaciation. These lands pose little or no threat to organic, sediment, debris, or pollutant introduction into the karst hydrologic systems beneath through diffuse recharge. Often these are areas of little or no slope (less than 20 percent). These tend to be at lower elevations, i.e. less than 500 feet, however the elevation of low vulnerability karst will vary across the Forest.

Timber harvesting and related activities could be conducted in such areas in a manner similar to those normally employed on lands underlain by non-carbonate rock.

Moderate Vulnerability Karst

The moderate vulnerability karst lands are those areas where resource damage threats associated with land management activities in the areas are appreciably greater than those posed by similar activities on low vulnerability karst lands. The following is a generalized characterization of these lands:

These areas, underlain by carbonate bedrock, are internally well drained. Surface streams are rare. The soils of moderate vulnerability areas are a mosaic of shallow organic soils of the Sarkar-McGilvery Complex (20-40 percent) and mineral soils of the Ulloa-Sarkar Complex (60-80 percent), with minor amounts of glacial till (see Table 3-5 for soil complex descriptions). The epikarst is moderate- to well-developed and is visible at the surface. These areas tend to be at higher elevations, i.e. greater than 500 feet, and on knobs, ridges, and on

the dip-slope of carbonate bedding planes when near the surface. The surface of these areas tends to be irregular and undulating, following the epikarst development, that is the result of solution of the bedrock surface rather than solution and/or collapse features such as sinkholes. In other words, moderate vulnerability features are often the result of slow, diffuse processes rather than collapse or major subsidence processes, which typify high vulnerability features. Moderate vulnerability karst lands pose low risk to organics, sediment, and debris introduction into the karst hydrologic systems beneath. It is probable, but not always the case, that these areas contain or are adjacent to areas of high vulnerability. Karst lands pose low risk to organics, sediment, and debris introduction into the karst hydrologic systems beneath. It is probable, but not always the case, that these areas contain or are adjacent to areas of high vulnerability.

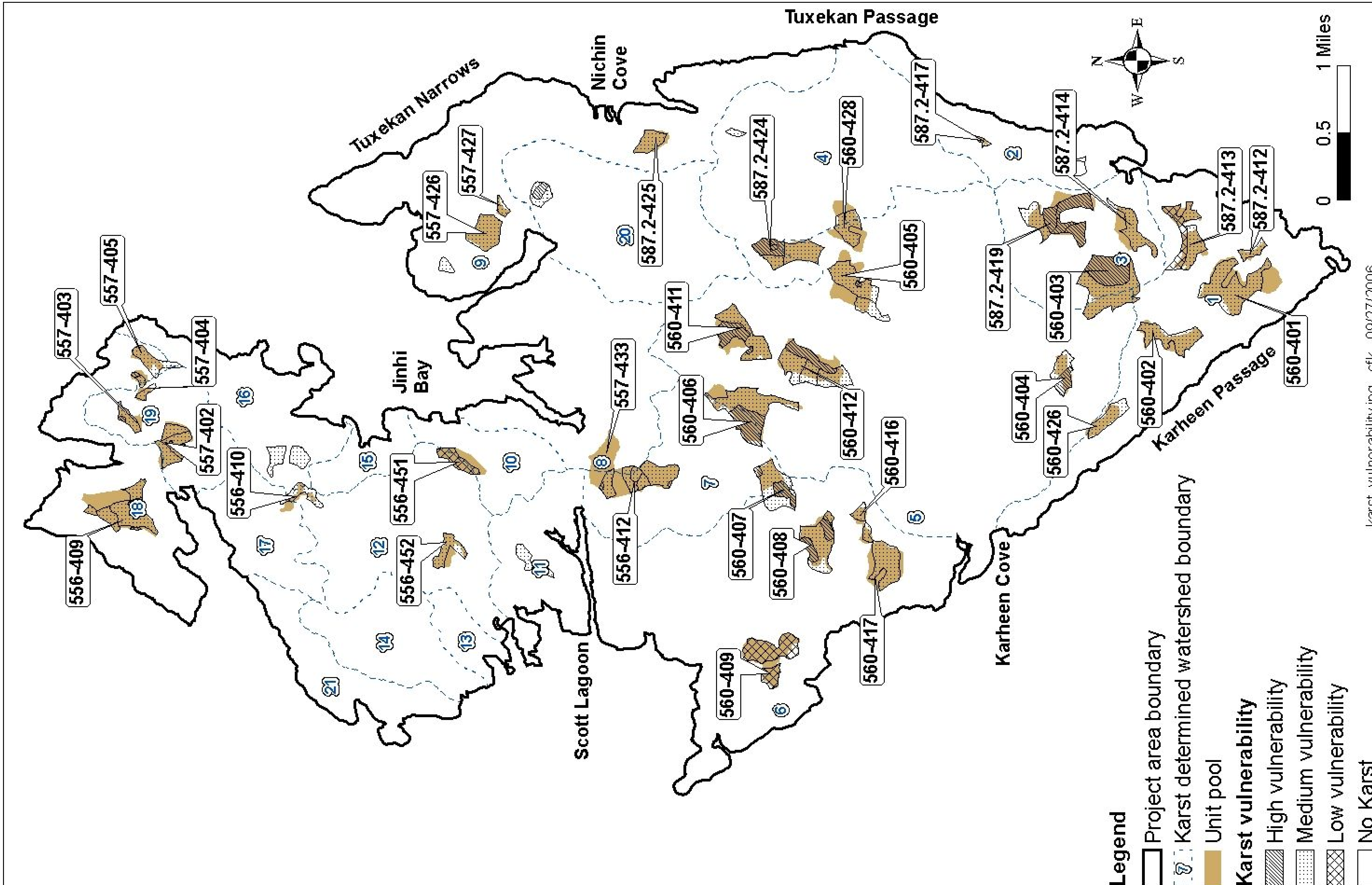

Figure 3-7. Map of karst vulnerability within the Tuxekan Project Area (URS, 2001)

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High vulnerability karst

The high vulnerability karst lands are those areas where resource damage threats associated with land management activities are appreciably greater than those posed by similar activities on low or moderate vulnerability karst lands. These are the areas contributing to or overlying significant caves and areas containing a high density of karst features. The following is a generalized characterization of these lands:

These areas, underlain by carbonate bedrock, are internally well drained. Surface streams are rare. Karst systems and epikarst are extremely well developed and collapsed karst features may be numerous. These include all collapsed karst features, caves, sinking or losing streams, insurgences, open resurgences, and open grikelands (i.e., those without soil or moss infilling and with open connections to the subsurface). The highest vulnerability features are those that could produce and transport the greatest amount of sediment, debris, and/or organics if disturbed. These include till-lined sinkholes and cave entrances accepting a sinking stream, whether intermittent or not. Also considered high vulnerability are karstlands in which the epikarst is well- or extremely well developed and the soils are predominately (>50 percent) very shallow organic (less than 10 inches deep, McGilvery), and (less than 50 percent mineral (less than 20 inches deep, Sarkar). The subsurface drainage network is highly vulnerable to sediment, organic matter, logging debris, and other pollutants generated as the result of surface activities.

Mining within the Project Area

As mentioned earlier, the carbonates of Southeastern Alaska are chemically pure, and have long been prized for their commodity values. Within the project area there is one mining claim that covers a portion of proposed harvest unit #560-401. The claim covers 25 acres and is for colored re-crystallized limestone. It is used for sculpture, tile, and ornamental applications (Baichtal, Pers Comm. 2005d). Excavation is limited and there has been no blasting. As a result, ground disturbance outside the mining claim is very limited.

Summary of Existing Harvesting and Roads on Carbonate

Past harvesting activities within the project area have been summarized in *Chapter 1, Past Activities*. Seventy-seven percent of the project area is underlain by carbonate rock (Table 3-29). Of the lands underlain by carbonate rock, 56.4 percent have been harvested in the past, and 14.7 percent will still be within the hydrologic recovery period in 2012.

Table 3-29. Summary of carbonate affected by past and current harvesting

Project Area	17,730 Acres	
Underlain by Carbonate Rock within Project Area	13,351 acres	75% of Project Area
Past harvesting on carbonate	7,543 acres	43% of Carbonate acres
Past harvest within the 30-year hydrologic recovery period by 2012	1,956 acres	11% of Carbonate acres

There are currently 56.3 miles of road on carbonate. Road densities by watershed are summarized in the Hydrology section. These densities include both existing and decommissioned roads.

Roads have been influencing ground and surface water hydrology to karst systems since the 1920s, when road construction began. They continue to influence hydrology unless the road is obliterated and the area is rehabilitated.

Project Monitoring Karst Resources

Implementation monitoring would be conducted annually per direction for karst and caves in the "*Monitoring and Evaluation Guidebook for the Tongass Land and Resource Management Plan*" (USDA FS 2000).

Effectiveness monitoring would be conducted annually per direction for karst and caves in the "*Monitoring and Evaluation Guidebook for the Tongass Land and Resource Management Plan*" (USDA FS 2000a).

Monitoring the effectiveness of BMPs for controlling sediment generation and entrainment into the karst system is recommended on any unit or associated NFS road that may pass through karst buffers.

Effectiveness monitoring of prescribed buffer windfirmness around significant karst features would also be conducted in coordination with effectiveness monitoring for soil and water components as suggested in the Forest Plan (USDA FS 1997a, Ch. 6 Monitoring).

The 2001 karst assessment conducted by URS identified karst features and their vulnerability; and conducted a dye injection study to help evaluate and delineate the associated hydrologic system, including groundwater, and catchment areas that contribute water to one or more karst related hydrologic systems. Dye injection studies are a fundamental tool used to understand groundwater conditions in karst areas (Harza 1995). The basic approach consists of introducing small amounts of a fluorescent tracer dye into insurgences or where water goes underground into the karst system. Potentially relevant springs, caves, and surface streams (resurgences) are then sampled to determine the presence or absence of the introduced dye. This information is important as waters originating in one watershed may actually discharge at the bottom of another watershed, as a result of going "underground". The results of this study, in association with the mapping of surface water pathways, and topographic boundaries were used to adjust the existing hydrologic unit code (HUC) boundaries, or watersheds. These adjustments were made to account for the subsurface pathways defined by the dye studies. As a result, all watershed boundaries shown in this EIS reflect current knowledge of karst hydrologic unit boundaries, and may cross-topographic divides.

Karst features identified within the project area include caves, insurgences, resurgences, sinkholes, collapse channels, and basins, areas of epikarst knobs, grikes, and solution rilling. The data collected on these features was summarized on karst feature forms, karst classification forms, and in field summary reports (URS 2001). The Forest Service found additional features in 2005 and some initial vulnerability ratings were re-classified. This information is summarized in Appendix I. Associated field reports and personal communications are found in the project file.

Aerial photographic interpretation and field reconnaissance indicate that past timber harvesting and road building has resulted in modifications to the hydrologic regime of the karst ecosystem within the project area. Observed changes include sediment deposits; the infilling of, and or blocking of, cave entrances by logging slash, sediment, and debris; waterline marks, and tannin staining and dissolution of fragile cave formations. Evidence that

flooding occurred in passages that have not experienced peak flows for centuries, was noted. The hydrologic changes are a function of alterations to the amount and timing of peak surface flows and flood regimes. In addition, flow volume has been increased where surface runoff from roads was diverted into karst features (USDA FS 1997b; USDA FS 1993; Baichtal and Swanston 1996).

Karst Direct/Indirect Effects

Water Quantity Direct / Indirect Effects

Water Quantity Direct / Indirect Effects Specific to Alternative 1 – No Action

All Forest Plan Standards and Guidelines as well as legal requirements would be met. As discussed under *Hydrology, Water Yield*, surface and groundwater flow regimes have been modified from past harvesting and road building. As no timber harvesting or road building is proposed under this alternative, there would be no further modification to water yields. Regeneration of forest vegetation, over time, would reduce any existing elevations in water yield.

Water Quantity Direct / Indirect Effects Common to Alternatives 2, 3, 4, and 5

The extensive use of stream and karst feature buffers, use of logging methods appropriate to the soils, slope, and for low and moderate vulnerability karst (where harvesting is allowed) would be used to prevent or limit soil erosion and the introduction of sediment into the karst systems. Use of helicopter, single-tree selection, and full and partial-suspension would also help reduce ground disturbance.

Table 3-30 displays the activities that would produce effects on carbonate by alternative.

Table 3-30. Activities producing effects on carbonate rock

	Alt 1	Alt 2	Alt3	Alt 4	Alt 5
Harvesting on carbonate - Tuxekan Project					
Single-tree selection (acres)	0	37	37	56	37
Clearcut with reserves (acres)	0	319	447	255	401
Total harvesting - Tuxekan Project	0	356	484	311	438
Road construction on carbonate (miles)	0	5.8	9.2	6.0	8.4

Of the activities producing effects on carbonate rock, Alternatives 3 and 5 would harvest the most (484 and 438 acres respectively) and Alternatives 2 and 4 the least (356 and 311 acres respectively).

Although proposed roads would be closed after implementation and BMPs applied, roads would continue to influence both surface and groundwater flow to some degree over the long term, simply due to the continued existence of the road prisms. However, application of BMPs, and monitoring would ensure that that these effects do not exceed those anticipated in the Forest Plan.

NFS road 1470320 accessing unit 560-416 has been relocated in Alternatives 3-5. Relocation places the road outside of the 100-foot buffer required for karst protection. No other caves or other significant karst features have been identified on the proposed route or along the proposed temporary road.

Alternatives 3 and 5 proposes the most road construction on carbonate rock (9.2 and 8.4 miles respectively) (Table 3-30) and Alternatives 2 and 4 the least (5.8 and 6.0 miles respectively).

Of the activities producing effects to water quantity on carbonate rock (i.e. harvesting and road building), Alternative 3 would propose the greatest and Alternative 4 the least.

Water Quantity Cumulative Effects

The analysis area for Water Quantity cumulative effects is Tuxekan Island and the time period is 1983-2012. Hydrologic recovery occurs after vegetation has reached 30 years. It is assumed for purposes of analysis that all proposed harvesting would occur by 2012. Therefore, harvesting that occurred before 1983 would have reached hydrologic recovery and no longer contribute to cumulative effects.

No additional timber harvest is proposed for implementation within the project area for the next five years.

Water Quantity Cumulative Effects Specific to Alternative 1 – No Action

Under this alternative, no additional harvesting would occur. Therefore, there would be no cumulative effects as a result of this project.

Water Quantity Cumulative Effects Common to Alternatives 2, 3, 4, and 5

Based on the use of BMPs, no cumulative effects will exceed those expected in the Forest Plan.

Table 3-31 displays, by alternative, the harvesting and roadbuilding that would occur on carbonate rock.

Of the activities having a cumulative effect on existing water quantity conditions of carbonate rock, Alternative 3 would have the greatest: harvest on carbonate rock would increase by 484 acres for a cumulative total of 27 percent increase island-wide (Table 3-31) and a 16.3 percent cumulative increase for road located on carbonate.

Alternative 4 would have the least cumulative effect on existing water quantity conditions of carbonate rock from harvesting with an increase of increase by 311 acres for a cumulative total of 16.3 percent increase island-wide (Table 3-31). Altarnative 3 would have the least cumulative effect on existing water quantity conditions of carbonate rock from road construction, with a 10.3 percent cumulative increase for road located on carbonate.

Table 3-31. Activities producing effects on carbonate rock by 2012

	Alt 1	Alt 2	Alt3	Alt 4	Alt 5
Proposed harvesting on carbonate - Tuxekan Project					
Single-tree selection (acres)	0	37	37	56	37
Clearcut with reserves (acres)	0	319	447	255	401
Total Proposed harvesting - Tuxekan Project	0	356	484	311	438
Harvesting on carbonate rock less than 30 years old (unthinned)	1,956	1,956	1,956	1,956	1,956
1K4 Percent increase of harvest acres on carbonate less than 30 years old by 2012	0	18	27	16	22
1K7 Miles of proposed temporary and NFS road on carbonate	0.0	5.8	9.2	6.0	8.4
Existing road on carbonate (miles)	56.3	56.3	56.3	56.3	56.3
1K8 Cumulative total number of road miles on carbonate (existing, decommissioned, and proposed)	56.3	62.1	65.5	62.3	64.7
1K9 Percent increase in miles of road on carbonate	0.0	10.3	16.3	10.7	14.9

Alteration of water yields is discussed in *Water Yield Direct, Indirect and Cumulative Effects* on pages 3-35 through 3-38.

Water Quality and Sediment Direct / Indirect Effects

Water Quality and Sediment Direct / Indirect Effects Specific to Alternative 1 – No Action

Under Alternative 1, no new temporary or NFS road would be built and no new potential sources of sediment would be created. Ongoing thinning would continue and is not expected to contribute any increase in sediment load, as ground disturbance is minimal.

Existing system and decommissioned roads would continue to supply sediment to drainage networks wherever surface runoff from roads or other disturbed areas, connect to drainage paths. However, the amount of additional flow, sediment, and potentially impacted water quality entering karst systems would be a function of how many of these drainages actually flow into the karst system.

Current sediment levels would essentially remain unchanged and therefore, existing water quality conditions would also remain unchanged. However, sediment levels and water quality could be affected if there was a major natural event. Such events would include windthrow and mass wasting. While windthrow is expected to continue, the chance for mass wasting is considered low to moderate (*Soil Erosion, Direct/Indirect Effects* Section). It is expected that historical levels of erosion and sediment transportation would also continue.

Water Quality and Sediment Direct / Indirect Effects Common to Alternatives 2, 3, 4, and 5

No temporary roads are proposed for construction on high vulnerability karst. No high vulnerability karst is proposed for harvest.

Units have been designed to comply with Karst and Cave Resources Standards and Guidelines, as well as with additional guidelines that are required where moderate and high vulnerability karst exist (USDA FS 1997c). These standards and guidelines require that timber harvesting and road construction near caves or significant karst features be designed to ensure the protection of these resources. These measures are intended to insure additional sediment is not introduced into the karst system, surface flows are not interrupted, and logging slash and debris are not transported in the karst system, which might plug insurgences or modify rates of oxygen consumption (USDA FS 1997c).

With the implementation of BMPs during construction, logging, closure, and maintenance, short-term increases in sediment may be expected during construction. However, these are expected to taper off over time. Road cut banks and fill slopes would be seeded with grass immediately after construction and maintenance to revegetate exposed soil. Although the application of BMPs would reduce impacts to an extent, existing and proposed roads would continue to function as long-term sediment sources.

Implementation of BMPs during road maintenance are expected to maintain conditions of cave and karst resources comparable to the existing condition.

Of the activities (harvesting and road building) producing effects to sedimentation and water quality on carbonate rock, Alternative 3 would proposes the greatest and Alternative 4 the least (Table 3-30).

Under Alternatives 3 and 5, approximately 2.0 miles of the 1470500 road would be reconstructed, as a section of the road is presently washed out by the ocean. Reconstruction is not expected to produce effects to the karst system, because the reconstruction location, along the coast, is below any surface flow inputs to the karst system...

Unit 560-408 is proposed for harvesting under Alternatives 3, 4, and 5. The proposed temporary road would cross over a karst collapse feature, requiring the installation of a bridge. This feature is located on moderate vulnerability karst (North, Pers. Communication 2005g). Geotextile fabric would be used on the bridge to keep aggregate overlay from falling into the collapse feature. Bridge installation and removal would result in short-term sediment increases into the collapse feature.

Water Quality and Sediment Cumulative Effects

The cumulative effects analysis area is Tuxekan Island and the time period for analyzing cumulative effects is 1983-2012. Hydrologic recovery occurs after vegetation has reached 30 years. It is assumed for purposes of analysis that all proposed harvesting would occur by 2012. Therefore, harvesting that occurred before 1983 would have reached hydrologic recovery and no longer contributes to cumulative effects.

No additional timber harvest is proposed for implementation within the project area for the next five years.

Water Quality and Sediment Cumulative Effects Specific to Alternative 1

Under this alternative, no additional harvesting would occur. Therefore, there would be no cumulative effects as a result of this project.

Water Quality and Sediment Cumulative Effects Common to Alternatives 2, 3, 4, 5

Based on the use of BMPs and Forest Plan Standards and Guidelines, no cumulative effects will exceed those expected in the Forest Plan.

The extent to which the Island's karst has been affected by past harvesting is unknown from a quantitative perspective. However, it is known that past harvesting and road building have had some degree of effect based on field observations (See Affected Environment). It is believed that intensity and method of past harvest has altered the hydrology of the karst systems and mobilized sediment and debris into these systems. Measures implemented in the design of the proposed harvest should minimize any additional cumulative effects. The proposed harvest methods, harvest unit size, road location and design, and the karst vulnerability assessment and mitigation proposed are intended to minimize impacts to the karst systems and the associated resources.

Data used in the analysis of cumulative effects is summarized in Table 3-31.

Existing and decommissioned road (56.3 miles) are located on underlying carbonate (Table 3-31).

The potential for change to existing water quality conditions and sediment loads are related to the cumulative percent increase in the amount of harvesting or treatment on carbonate rocks, the cumulative percent increase of roads (decommissioned, existing and proposed) on carbonates, and the percent increase in the number of miles of road located on carbonate.

Of the activities having a cumulative effect on existing water quality conditions and sediment loads on carbonate rock, Alternative 3 would have the greatest: harvested on carbonate rock would increase by 484 acres for a cumulative total of 27 percent increase island-wide (Table 3-31) and a 16.3 percent cumulative increase for road located on carbonate.

Alternative 4 would have the least cumulative effect on existing water quality conditions and sediment loads on carbonate rock from harvesting, with an increase of increase by 311 acres for a cumulative total of 16.3 percent increase island-wide (Table 3-31). Altarnative 3 would have the least cumulative effect on existing water quantity conditions of carbonate rock from road construction, with a 10.3 percent cumulative increase for road located on carbonate.

Issue 2: Timber Sale and Local Economics

The proposed project may not provide jobs and income benefiting local residents or provide a positive economic return to timber sale purchasers.

Table 3-32. Units of measure for Issue 2

Measurement Number	Number of direct jobs potentially supported
2TSE1	Number of direct jobs potentially supported
2TSE2	Direct income potentially supported ($)
2TSE3	Expected Bid Value ($)
2TSE4	Volume available for small sales (mbf)

Table 3-33 summarizes the analysis of results used to compare effects to timbersale and local economics for Issue 2.

Table 3-33. Summary of Effects

Measurement		Alt 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
2TSE1	Number of direct jobs potentially supported	0	97	129	79	117
2TSE2	Direct income potentially supported ($)	$0	$3,568.496	$4,779,795	$297,555	$4,333,073
2TSE3	Expected Bid Value ($)	$0	$618,747	$716,673	$214,642	$471,826
		$0/ccf	$20.50/ccf	$17.72/ccf	$8.67/ccf	$12.87/ccf
		$0/mbf	$40.99/mbf	$35.45/mbf	$17.33/mbf	$25.74/mbf
2TSE4	Volume available for small sales (mbf)	0	2.7	2.7	1.8	1.7

Methodology

The Tuxekan project area is the analysis area for direct and indirect effects of the alternatives. Southeast Alaska is the analysis area for cumulative impacts of the Tuxekan Project. The livelihood of many area residents is connected with the Tongass. Mills in Southeast Alaska process most of the timber sold from the Tongass; these mills also employ a number of local residents.

The evaluation of cumulative effects relative to economic impacts for all alternatives focuses on past, present, and reasonably foreseeable activities through 2010 Analysis of this five-year period allows for consideration of impacts from the full implementation of the action alternatives in combination with projected harvests by State and private entities, which were available for 2005 through 2009.

The economic analysis was conducted using an Excel workbook entitled NEPA Economic Analysis Tool (NEAT). NEAT provides a preliminary appraisal based on the Transaction Evidence appraisal method. The analysis compares estimated sale costs and net stumpage values for high and low market conditions. This comparison should be used only for relative values and not for exact monetary values. The expected bid rate for the last 15 quarters is used to display an action alternative's ranking based on the alternative's estimated timber quantity, quality, and logging efficiency. These market scenarios are used to display the cyclical nature of timber markets and are not intended to imply a final appraised stumpage value. For the action alternatives, the estimated harvest volume and logging costs remain constant, regardless of the market scenario. All alternatives have been appraised with a required removal to a 6-inch top diameter and domestic processing of western red cedar

Timber Sale and Local Economics Affected Environment

The communities in Southeast Alaska are dependent to varying degrees on the Forest's abundant natural resources. The jobs created by the forest products sector are a vital component of the economies of some small communities. Family-owned, community-based

sawmills and other wood product users in and around these communities rely upon a stable supply of wood.

Nearly 80 percent of Southeast Alaska is within the 17 million-acre Tongass National Forest. This area stretches along the coast and coastal islands for about 500 miles between Yakutat in the northwest and Ketchikan in the south. The area has a very low population density, with 73,082 people living in approximately 33 cities, towns, and villages scattered throughout the region. Juneau, located near the north end of the Forest, has the largest population in the region (30,711), followed by Ketchikan (14,070) in the south.

The area covered by the Tuxekan Island Timber Sale is approximately 17,730 acres and is located entirely on Tuxekan Island, just off the northwest coast of Prince of Wales Island. The nearest community to the project area is the logging community of Naukati, located on the west shore of Prince of Wales Island. The project is located within the Thorne Bay Ranger District.

The regional economy has changed in the last decade. Between 1990 and 2000, regional employment in services and the retail trade showed large growth while manufacturing jobs declined. These changes reflect growth in recreation and tourism-based employment and a 78 percent decline in timber-related employment (Forest Plan Final Supplemental EIS, page 3-251).

The communities of Southeast Alaska and Prince of Wales Island depend on the Tongass National Forest to provide the foundation for natural resource-based industries, which comprised 23 percent of regional employment in 2001. Within this sector, wood products comprised 9 percent, commercial fishing and fish processing, consists of 37 percent, recreation and tourism covers 51 percent, and mining and mineral development, made up 3 percent of the Southeast Alaska employment sector (Forest Plan Final Supplemental EIS, page 3-245). Many residents also depend on subsistence hunting and fishing on national forest system lands to meet their basic needs. Appropriate management of the forest’s natural resources is, therefore, important for local communities and the overall regional economy.

The forest products industry has been an important part of the economy of Southeast Alaska since the 1950s. From 1987 through 1996, the forest products industry provided direct employment for an average of 2,791 workers. Indirect employment, which includes related service activities such as transportation, marketing, and equipment sales and maintenance, provided an additional 2,014 jobs. Direct and indirect employment during this period peaked in 1990 with 3,543 and 2,570 jobs, respectively (Forest Plan Final Supplemental EIS, page 3-249).

Wood products employment was reduced due to lower market conditions and the closure of the pulp mill in Ketchikan in 1997. With that closure, employment in this category was reduced by about 520 jobs. In 2001, total wood products employment in Southeast Alaska was approximately 782 jobs (Forest Plan Final Supplemental EIS, page 3-249).

Timber Supply and Market Demand Affected Environment

Within a defined area such as the Tuxekan project area, the quantity of timber available for harvest is determined by the following:

- Site capability
- Silvicultural prescription

- Acreage of suitable timberland containing commercial species on stable soils and able to regenerate within 5 years
- Compatible land use designation (LUD)

The Timber Production LUD allows timber harvesting in the project area. Approximately 5,910 acres of second growth that is currently too young for commercial thinning is classified as suitable and available. There are approximately 3,787 acres of suitable and available old-growth timber on National Forest System lands that have not been harvested. This remaining suitable and available forest land is located entirely on land currently classified as suitable for timber production.

The annual market demand for timber is developed based on the document "Evaluating the Demand for Tongass Timber" (Morse, 1998), which forms the basis for how these estimates are developed. Final procedures are located in Responding to the Market Demand for Tongass Timber (Morse 2000). The document, Tongass National Forest Timber Sale Procedures (Morse 2000), explains the process used to determine the volume of timber offered each fiscal year. The Regional Office recaluculates estimated demand annually. The results of that calculation form the basis for the Tongass' planned timber offer for the current year of the Five Year Timber Sale Schedule pending sufficient funding to do so.

The 2006 analysis of timber sale demand for the Tongass estimates that 143 mmbf would be required to meet the objectives for volume under contract. Industry capacity in active mills was estimated at approximately 255 mmbf in fiscal year 2003. Capacity utilization is estimated to be 10 percent under a low market scenario and 20 percent under a high market. The demand analysis estimates that the Tongass provided approximately 64 percent of the raw material processed by these mills in 2003 (USDA 2005a).). As of September 30, 2005, the remaining volume under contract on the Tongass was 82.6 mmbf (USDA 2005b).

Determining market demand is a complex process. Detailed explanations of the rationale for considering timber harvest in the Tuxekan project area and market demand for wood products are provided in Appendix A of this document. For further explanation of the timber supply and market demand in Southeast Alaska, refer to the Forest Plan FEIS (USDA FS 1997b).

Timber Sale and Local Economics Direct / Indirect Effects

Timber Sale and Local Economics Direct / Indirect Effects Common to All Alternatives

Financial Efficiency

The financial efficiency analysis is a comparison of those costs and benefits that can be quantified in terms of actual dollars spent or received within the project area. A financial efficiency analysis offers a consistent measure in dollars for comparison of alternatives. It should not, however, be viewed as a complete answer, but only as a tool that the responsible official can use to compare alternatives and the trade-offs between costs and benefits. Financial efficiency does not account for non-market benefits, opportunity costs, individual values, or other benefits, and costs that are not easily quantifiable. These will be discussed qualitatively in the Social and Economic section later in this chapter.

Financial Cost Analysis

Financial cost analysis compares the estimated cost in appropriated dollars for each alternative. The average Region 10 budget allocation and management expenses are used for the analysis. The costs and management expenses include environmental analysis, sale preparation, sale administration, and engineering support. For this analysis, Forest Service costs are estimated based on the Region 10 average budget allocation of $20.50/ccf for environmental analysis, $11.50/ccf for sale preparation, $4.50/ccf for sale administration, and $14.00/ccf for engineering support. Actual costs may vary depending on conditions specific to each sale. Some of the factors that may influence actual costs are described below.

Environmental Analysis

Environmental analysis costs include field inventory and the analysis of data, public involvement, and the preparation of a document that satisfies the requirements of NEPA. The timeframe for the environmental analysis is typically about two years and involves many resource specialists. Although it is based on timber volume, the cost also fluctuates with the amount of area to be examined, the accessibility of that area, and the complexity of the issues associated with the project. The Tuxekan project area is accessible only by barge or floatplane. Therefore, the cost of transportation to the area is greatly increased when compared to other project areas accessible by an existing road system connected to a main highway transportation system. The environmental analysis cost is the same for each alternative, including the No Action alternative, and is based on the volume of Alternative 3 (Proposed Action). One of the benefits of the environmental analysis that cannot be quantified is the resource knowledge gained from the project area inventory and analysis. This may be used to benefit future forest management.

Sale Preparation

Unit layout and cruising costs increase significantly when partial harvesting instead of clearcutting is prescribed. An example of this cost increase was documented in the Alternatives-to-Clearcutting Research Study on Kupreanof Island (USDA FS 2000d). This study found that harvesting prescriptions other than clearcutting required about eight times more person-days to prepare per unit, because individual trees need to be marked throughout the unit. Designation of two-acre patches took about four times longer than a clearcut. Accessibility to the units is another major cost factor. Helicopter access and steeper terrain increase sale preparation costs and exceed costs for areas with existing road access.

Sale Administration

Sale administration costs are higher when helicopter logging is involved because of the increased cost of accessing the timber harvest for administration. Scattered and smaller harvest areas are more costly to visit.

Engineering Support

Engineering support costs are increased when the project area is isolated from the main highway system (on Prince of Wales Island). Fortunately, most of the classified road segments are relatively short so helicopter costs for road layout and survey would be minimal. Road design costs are likely to be below average since less than average numbers of stream crossings typically occur on karst topography. In addition, only one Class I crossing is

proposed for all alternatives. Except for costs associated with traveling to the island, contract inspection costs for construction, reconstruction, and maintenance should be average to below average.

Timber Sale and Local Economics Specific to Alternative 1 Direct / Indirect Effects

Financial Cost Analysis

Financial cost under Alternative 1, the No Action Alternative, is $828,927 and is tied to the cost of the environmental analysis. No costs would be incurred for sale preparation, sale administration, or engineering support.

Small-sale Opportunities

There would be no small-sale opportunities under this alternative.

Contributions to Local Employment

There would be no contributions to local employment or income under the No Action Alternative.

Timber Sale and Local Economics Common to Alternatives 2, 3, 4, and 5 Direct and Indirect Effects

NIC I and NIC II

The allowable sale quantity (ASQ) represents the maximum quantity of timber that may be sold in each decade from suitable lands covered by the Forest Plan. The ASQ is divided into two non-interchangeable components (NICs) based on economic factors. Timber harvesting is easiest and most economical on NIC I lands. On average, sales from these lands have the highest probability of offering a reasonable opportunity for a purchaser to profit from his/her investment and labor. NIC I lands are considered by the Forest Plan to be the best operable ground, accounting for approximately 80 to 82 percent of the ASQ. Normal operability includes those harvest systems most frequently used in the Tongass. These systems are tractor, shovel, standard cable, and some helicopter (USDA FS 1997b).

The NIC II lands are more difficult to access or harvest and, are therefore, less economical than NIC I lands. Most of these lands are presently considered economically and technologically marginal. NIC II lands include timber volumes that are available for harvest using systems that are not commonly used in Southeast Alaska. Difficult operability includes those systems used in the Tongass that have significantly higher costs. These may include balloon, long-span skyline, multispan, or helicopter with yarding distances greater than three-quarters of a mile. Lands classified as NIC II also have limited access as a result of isolation due to prior harvest activities or other management activities (USDA FS 1997b).

Harvesting of commercial National Forest System land within the Tuxekan project area does not include any acres of NIC II lands. All proposed harvest acres (443 in Alternative 2, 573 in Alternative 3, 381 in Alternative 4, and 522 in Alternative 5) are considered normal operability and, therefore, classified as NIC I lands.

Timber Sale and Local Economics Financial Efficiency Analysis

The estimated harvest volumes, expected values, costs, and net stumpage values projected in this document at this time are not definitive figures. These estimates are useful for comparing the alternatives but should not be used for determining actual sale volume, costs, or values. Merchantable timber within units and any road construction right-of-way located on National Forest System lands are cruised to determine the quantity, quality, and value of timber for the contract under which the timber is offered. The final sale appraisal includes current quarter selling values, current cost information and a normal profit and risk allowance to determine the minimum advertised stumpage value at the time of offering. Competitive bidding determines the actual value of the timber.

A preliminary appraisal was conducted for the action alternatives using the NEPA Economic Analysis Tool (NEAT) workbook described in the Social and Economic Report in the project file. The estimated harvest volumes, expected bid values, costs, and net stumpage values presented in this document are not definitive figures. These estimates are useful for comparing the alternatives but should not be used for determining actual sale volume, costs, or values.

Although individual timber harvesting units may or may not be economical to harvest by themselves, the management of less productive lands or lands containing a high percentage of defective timber would help to increase future timber yields. The harvesting of units with higher returns would help to compensate for those units yielding less economic returns.

Estimated harvest volumes under the action alternatives are displayed in Table 3-34, below.

Table 3-34. Estimated timber harvest volumes

Species	Alt 2 (ccf)[a]	Alt 3 (ccf) [a]	Alt 4 (ccf) [a]	Alt 5 (ccf) [a]
Spruce	5,024.6	6,844.9	4,251.7	6,231.8
Hemlock	18,615.3	24,925.3	14,747.2	22,783.2
Alaska yellow-cedar	0.0	0.3	0.1	0.3
Western red cedar	6,547.1	8,664.9	5,766.9	7,640.9
Total	**30,187.0**	**40,435.4**	**24,765.9**	**36,656.2**

[a] Volumes for Alternative 2, 3, and 4 have changed from those published in the Draft EIS due to updates to the NEAT spreadsheet and to the Stand Exam Data. Volumes in ccf may be converted to mbf by multiplying by a factor of 0.5.

The results of the financial efficiency analysis are displayed in Table 3-35. All action alternatives are projected to have positive expected bid values. These values are not definitive, but they suggest that each alternative has the potential to provide a positive economic return for the timber sale purchaser(s). Although estimated harvest volumes are slightly lower under Alternative 2, the expected bid value is higher due to lower logging and road costs than under Alternatives 3 through 5.

Table 3-35. Estimated harvest economic efficiency analysis: timber sale values and costs to an operator of average efficiency by alternative [a]

Cost / Value	Alt 2	Alt 3	Alt 4	Alt 5
Logging Cost per ccf	$126.03	$131.73	$144.79	$135.28
Road Cost per ccf	$25.53	$31.95	$31.22	$30.92
Expected Bid/ccf (net stumpage rate)	$20.50	$17.72	$8.67	$12.87
Expected Bid Value	**$618,747**	**$716,673**	**$214,642**	**$471,826**

[a] Source: USDA Forest Service NEAT Analysis, 2005.

Based on recent export trends for the Tongass National Forest as a whole, approximately 25 percent of the Western red cedar (1,637 ccf under Alternative 2; 2,166 ccf under Alternative 3; 1,442 ccf under Alternative 4; and 1,910 ccf under Alternative 5) could potentially be exported.

Financial Cost Analysis

The total estimated budget costs for the financial cost analysis of all the alternatives are displayed in Table 3-36.

Table 3-36. Financial cost analysis: costs by project alternative[a]

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Volume (mmbf)	0	15.1	20.2	12.4	18.3
Costs					
Environmental Analysis	$828,927	$828,927	$828,927	$828,927	$828,927
Sale Preparation	$0	$347,150	$465,008	$284,807	$421,546
Sale Administration	$0	$135,841	$181,960	$111,446	$164,952
Engineering Support	$0	$422,618	$566,096	$346,722	$513,186
Total Costs	**$828,927**	**$1,734,536**	**$2,041,991**	**$1,571,902**	**$1,928,611**

[a] Source: USDA Forest Service NEAT Analysis, 2005

Net revenue (expected bid value less project costs) is projected to be negative for all action alternatives at -$1,115,789, -$1,325,318, -$1,357,260, and -$1,456,785 for Alternatives 2, 3, 4 and 5 respectively. Among the action alternatives, project costs under Alternative 4 are lowest, however net revenue is highest under Alternative 2. Alternative 5 followed by Alternatives 4 and 3 would provide the lowest net revenue.

Large and Small Sale Opportunities

The majority of the volume to be harvested would be offered as large timber sales. Harvest of these units would involve significant road construction and/or reconstruction or have logging system requirements beyond the capabilities of local, small operators. Volumes available for large sales would be 12.4, 17.5, 10.6, and 16.6 mmbf under Alternatives 2, 3, 4, and 5 respectively.

A number of specific harvest units have been identified that could provide small-sale opportunities for local timber operations. Units 557-404, 560-404, 560-406, 587.2-417, 587.2-425, and sections of units 560-401 and 560-405 would involve primarily shovel or small cable systems, and little or no road construction. Only a small amount of road reconstruction would be required to access these units, provided that considerable reconstruction occurred first under a separate contract. Investments in road maintenance on timber haul routes would help with the economics of future commercial thinning and small sales.

The total volume available from all of the units listed under small-sales opportunities above would be 2.7 mmbf under Alternatives 2 and 3, 1.8 mmbf under Alternative 4, and 1.7 mmbf under Alternative 5. This volume represents the largest small sale offering under each alternative. Smaller sales could be provided on an individual unit basis, depending on market conditions at the time of sale offer.

Contributions to Local Employment

The potential amount of employment and income resulting from timber harvesting is estimated using coefficients developed for Southeast Alaska. The direct employment coefficient for sawmills is 3.95 jobs per mmbf of net sawlog volume utilized to manufacture sawn products. This coefficient was developed using data obtained from sawmill surveys in 2000, 2002, and 2003. Each sawmilling job represents an average (2001-2003) of $32,500 of income per year. The direct logging (including road building) employment coefficient used was 2.44 jobs per mmbf. This number was developed from Tongass employment and total sold volume 1999-2003, from the ANILCA 706(A) report for 2003. Each logging job represents an average (2001-2003) of $44,280 of income per year (Alexander 2005).

Indirect job and income impacts were not estimated. Robertson (2003) found that even in small communities where shifts in basic employment may be extreme, the economic base hypothesis (sometimes referred to as indirect job effects) is not supported by the empirical evidence. Linear indirect impact multipliers derived from modeling are, therefore, not applicable in small communities. “The presence of significant secondary impacts resulting from changes in resource-based economic activity cannot be taken as a matter of fact” (p.84). Robertson goes on to explain that although outside income sources and local economic activity are inter-related, the basic sectors of a local economy are not independent pieces that can be linearly modeled and the impacts added to summarize total impacts. Indirect employment coefficients are applicable at large scales, such as large regional or statewide assessments. However, they are not useful at small local scales, and are in fact misleading (Alexander 2005).

The sale and harvest of timber under the action alternatives would impact the economy of local communities. Any timber volume made available from the decision on the Tuxekan Island Timber Sale EIS could, depending on market conditions, be harvested in multiple sales. The jobs supported may occur over a period of years. However, the number of jobs estimated below is based on a one-year time frame.

Table 3-37 displays the estimated direct job impacts projected under Alternatives 2, 3, 4, and 5.

Table 3-37. Direct job impacts by alternative[a]

Income Category	Number of Jobs			
	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Sawmills	60	80	49	72
Logging (incld. road const.)	37	49	30	45
Total	**97**	**129**	**79**	**117**

[a] Source: USDA Forest Service NEAT Analysis, 2005

Table 3-38 displays the estimated direct income impacts projected under Alternatives 2, 3, 4, and 5.

Table 3-38. Direct income impacts by alternative[a]

Income Category	Direct Income			
	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Sawmills	$1,937,692	$2,595,422	$1,589,661	$2,352,857
Logging (incld. road const.)	$1,630,804	$2,184,363	$1,337,894	$1,980,216
Total	**$3,568,496**	**$4,779,785**	**$2,927,555**	**$4,333,073**

[a] Source: USDA Forest Service NEAT Analysis, 2005

Approval to export cedar would reduce the potential number of local jobs created by the alternatives. Based on recent export trends on the Tongass National Forest, approximately 75 percent of the Alaska yellow-cedar harvested and 25 percent of the Western red cedar could potentially be exported. This would constitute approximately 5.4 percent of the total estimated harvest volume under Alternatives 2 and 3; 5.8 percent under Alternative 4; and 5.2 percent under Alternative 5. The estimated number of jobs and income supported in the sawmill sector within the analysis area under each alternative would be reduced by a corresponding amount. Those jobs would instead occur outside the analysis area. Forest-wide export rates may not reflect purchases by smaller operators, who may be less likely to seek or utilize export markets.

Timber Sale and Local Economics Cumulative Effects

Timber Sale and Local Economics General Cumulative Effects

As stated earlier, the cumulative effects analysis area for the timber sale and local economics issue is Southeast Alaska thorugh 2010. These spatial and temporal boundaries are used because mills in Southeast Alaska process most of the timber sold from the Tongass; these mills also employ a number of local residents. The period analyized allows for the consideration of impacts from the full implementation of the action alternatives in combination with projected harvests by State and private entities, which were available for 2005 through 2009.

Table 3-39, below, displays the planned volume of timber to be offered for sale in Southeast Alaska on all land ownerships during the current five-year planning period. It should be

noted however, that the while the private harvest volumes estimated below contribute to the satisfaction of overall demand, this timber is generally owned by native corporations and is not available for purchase by other mills.

Table 3-39. Estimate of timber harvest opportunities in Southeast Alaska, 2006-2010

Source[a]	Estimated Southeast Alaska Planned Timber Offer (mmbf) by Year					
	Under Contract (as of approx. 01/30/06)	2006	2007	2008	2009	2010
Tongass National Forest	82.6	84.0	135.0	201.0	138.0	162.0
Alaska Department of Natural Resources	49.7	25.1	17.9	18.4	18.7 [c]	22.5[c & d]
Private (planned harvest)	Unknown	82.0[e]	82.0[e]	82.0[e]	82.0[e]	82.0[e]
Total	**132.3**	**191.1**	**234.9**	**301.4**	**238.7**	**266.5**

[a] Source: USDA Forest Service Fiscal Year 06 5-Year Sale Plan, 2006 and ADNR Division of Forestry, Coastal Region Southern southeast Area Five-Year Schedule of Timber Sales: Calendar Years 2005 through 2009 and Coastal Region, NSE Area Haines State Forest Five-Year Forest Management Schedule: January 1, 2004 through December 31, 2008; Palmieri (ADNR) 2006; and Slenkamp (ADNR) 2006.

[b] mmbf = million board feet

[c] Planned volumes for the Northern Southeast Region were unavailable beyond 2008. A five-year average was used to estimate volume for this year.

[d] Planned volumes for the Southern Southeast Region were unavailable beyond 2009. A five-year average was used to estimate volume for this year.

[e] Actual estimated volumes to be harvested by private entities were not available for these years, therefore the assumption was made that harvest volumes would be similar to estimates for 2005, which were based on estimates provided by Alaska Department of Natural Resource for 2005.

Timber Sale and Local Economics Cumulative Effects Specific to Alternative 1

No timber would be harvested for this project from the project area. Planned harvest levels under all ownerships listed above may or may not occur. In order to meet the estimated demand for timber, more timber may need to be harvested elsewhere on the Tongass.

Timber Sale and Local Economics Cumulative Effects Common to Alternatives 2, 3, 4, and 5

A stable timber economy depends on an even-flow supply of timber that operators can depend on in order to make investments in machinery and to employ qualified workers. The amount of timber harvested also affects the availability of timber in the foreseeable future and contributes to the long-term timber supply. Timber from the Tuxekan project area would constitute one portion of the timber supply available for public consumption. More complete evaluations are found in Appendix A of this document, as well as in the Forest Plan.

Timber from the project area has been contributing to the timber industry of Southeast Alaska since the 1940s, particularly from the 1960s through 1980s when most of the harvesting and road construction occurred. Approximately 7,779 acres of timber has been harvested from the project area. In addition to providing timber access, the roads have been

used to access second growth stands for pre-commercial thinning and would be used to access commercial thinning areas in the future.

Reasonably foreseeable actions include the planned timber harvest on National Forest, State, and private lands described above. Timber volumes projected for harvest from private lands may not be available for purchase by all potential timber operators. National Forest and State timber sale proposals would be subject to environmental review and approval and may or may not occur as planned. However, planned offerings from 2006 through 2010, which include estimated contributions from the Tuxekan Project, would be expected to maintain an adequate supply of timber to support the local wood products industry in the near term.

Issue 3 – Wildlife

Issue 3a

Issue # 3a – Biodiversity – Old-Growth Reserves and Connectivity: The small old-growth reserves as originally mapped do not meet Forest Plan minimum requirements. There is concern that because of past harvest on the island habitat connectivity between small old-growth reserves would be further compromised.

See Comparison of Alternatives by Issues located in Chapter 2.

Table 3-40. Units of measure for analysis of issue 3a

Measurement Number	Measurement
3aW1	Percent of the VCU in old-growth reserves (See Table 3-48)
3aW2	Percent of old-growth reserve in productive old-growth (See Table 3-48)
3aW3	Analysis of connectivity between reserves (See Habitat Connectivity Section – Connectivity Analysis)

Issue 3b

Issue #3b – Subsistence: Proposed harvesting in the project area will reduce high value deer habitat adversely impacting subsistence users.

Table 3-41. Units of measure for analysis of issue 3b

Measurement Number	Measurement
3bW1	Results of the deer model (habitat capability[a], deer/sq. mile) (See Table 3-54 and Table 3-55).
3bW2	Acres of high value deer habitat available (See Table 3-56)

[a] habitat capability is defined as the long-term potential of an area to support animals rather than an estimate of actual numbers present.

Table 3-42 summarizes the analysis of results used to compare effects for Issue 3 Wildlife.

Table 3-42. Comparison of effects by alternative for Issue 3

Issue 3: Wildlife

The cumulative effects analysis area for small OGRs and for connectivity is the four VCUs and Tuxekan Island (project area). Cumulative effects relative to time span for small OGRs are generally limited to the short-term (<10 years) and long term (>10 years).

The analysis area for direct, indirect, and cumulative effects on subsistence is Wildlife Analysis Area 1531 as this area encompasses the proposed project area. The time frame considered is until the end of the Plan rotation, approximately 2095, in order to evaluate the effects of the alternatives in concert with full Forest Plan implementation.

<table>
<tr><td colspan="6">3a. The small old growth reserves as originally mapped do not meet Forest Plan minimum requirements. There is concern that because of past harvest on the island habitat connectivity between small old growth reserves would be further compromised.</td></tr>
<tr><th>Measure</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th><th>Alt 4</th><th>Alt 5</th></tr>
<tr><td colspan="6">3aW1 Percent of the VCU in old-growth reserves</td></tr>
<tr><td>VCU 556</td><td>10</td><td>19</td><td>19</td><td>20</td><td>20</td></tr>
<tr><td>VCU 557</td><td>8</td><td>16</td><td>16</td><td>16</td><td>16</td></tr>
<tr><td>VCU 560</td><td>11</td><td>19</td><td>17</td><td>19</td><td>19</td></tr>
<tr><td>VCU 587.2</td><td>20</td><td>17</td><td>21</td><td>17</td><td>17</td></tr>
<tr><td colspan="6">3aW2 Percent of old-growth reserve that is productive old-growth.</td></tr>
<tr><td>VCU 556</td><td>58</td><td>83</td><td>74</td><td>84</td><td>84</td></tr>
<tr><td>VCU 557</td><td>45</td><td>71</td><td>70</td><td>71</td><td>71</td></tr>
<tr><td>VCU 560</td><td>46</td><td>74</td><td>72</td><td>74</td><td>73</td></tr>
<tr><td>VCU 587.2</td><td>82</td><td>95</td><td>61</td><td>94</td><td>94</td></tr>
<tr><td>3aW3 Analysis of connectivity between reserves</td><td>The small OGRs would remain as currently mapped. Three of the four reserves do not currently meet Forest Plan minimum requirements or mapping criteria.</td><td>The boundaries of the four small OGRs in the project area would be adjusted according to the interagency committee’s recommendations, but minor revisions of the interagency small OGRs in VCUs 557 and 587.2 would be made to accommodate harvest in two small areas.</td><td>The boundaries of the four small OGRs in the project area would be adjusted in limited ways to include additional old-growth stands and high-value deer winter range, and to meet Forest Plan acreage requirements</td><td>Fully implements the interagency committee’s recommended boundary changes to all four small OGRs in the project area</td><td>Fully implements the interagency committee’s recommended boundary changes to all four small OGRs in the project area</td></tr>
<tr><td colspan="6">3b. Proposed harvesting in the project area would reduce high-value deer habitat adversely impacting subsistence users.</td></tr>
<tr><th>Measure</th><th>Alt 1</th><th>Alt 2</th><th>Alt 3</th><th>Alt 4</th><th>Alt 5</th></tr>
<tr><td rowspan="2">3bW1 Results of the deer model for WAA1531[a] (habitat capability, deer/sq. mile) [b] with predation.</td><td>1,437 deer; 26/mi^2</td><td>1,421 deer; 26/mi^2</td><td>1,415 deer; 25/mi^2</td><td>1,423 deer; 26/mi^2</td><td>1,417 deer; 25/mi^2</td></tr>
<tr><td colspan="5">Predicted habitat capability exceeds the minimum requirement of 17 deer per square mile (Forest Plan Clarification Papers 1998) and the recommendation of 18 deer per square mile (2000 Monitoring and Evaluation Report)</td></tr>
<tr><td rowspan="2">3bW2 Acres of high value deer habitat available</td><td>8,717</td><td>8,302</td><td>8,177</td><td>8,360</td><td>8,224</td></tr>
<tr><td colspan="5">Of the action alternatives, Alternatives 2, 4 and 5 maintain the most winter habitat for deer, This is due to implementation of the interagency recommendations for small OGRs, increased amount of coarse-structured stands protected in small OGRs, and less harvesting of high-value habitat and volume class 6 and 7 stands, compared to Alternative 3. Both Alternatives 3 and 5 results in a 6% reduction of high value deer habitat available.</td></tr>
</table>

[a] Deer model results are calculated at the WAA scale, and not the smaller project scale.

[b] Habitat capability is defined as the long-term potential of an area to support animals rather than an estimate of actual numbers present

Biodiversity

Biodiversity Affected Environment

Biodiversity can be defined as the variety of all plant and animal communities and species within an area, as well as associated ecological processes. The Forest Plan FEIS (USDA FS 1997b) discusses biodiversity in detail on pages 3-11 through 3-26 and is incorporated here by reference.

Appendix N of the Forest Plan FEIS summarizes results of additional analysis and risk assessments of wildlife habitat conservation measures incorporated into the Forest Plan, including components of biodiversity. Appendix N is incorporated here by reference.

The conservation of biodiversity commonly requires a dual strategy addressing both individual species as well as entire ecosystems (Marcot et al. 1994). The traditional species-by-species approaches are important for featured or management indicator species, sensitive or rare species, and for recovery of federally-designated threatened or endangered species. A more comprehensive strategy focused on higher levels of biological organization and ecosystems may be necessary to conserve rare or declining habitats such as old-growth forests, plant and animal communities, and ecosystems, as well as the entire complement of associated biota and ecological processes (Franklin 1993; Noss 1991; Scott et al. 1991).

For the Tongass in general, and the Tuxekan project area specifically, habitat needs for sustaining viable populations of individual species are addressed by guidelines for specific species or species groups. This is the "fine filter" approach to biological conservation. Forest Plan Standards and Guidelines relate to the "fine filter" and to management activities within the matrix as discussed in Appendix N. These management activities are implemented on a stand level.

The old-growth conservation strategy has two basic components; a forest-wide system of old-growth reserves and other non-development LUDs; and management of the matrix between the reserves. Beach and estuary fringes, riparian management areas (RMAs), high vulnerability karst, standards and guidelines for management in the matrix, and other areas excluded from timber harvesting contribute to the conservation strategy by maintaining important components of old-growth ecosystems in the matrix and habitat connectivity between the reserves. Forest fragmentation is what happens when large contiguous patches of forests are fragmented, or split up, into several smaller patches. These remaining patches (the matrix) are separated by habitats other than mature forest and may include clearcuts, development, or young forests.

When a landscape is fragmented overall community diversity may stay the same or increase, but the integrity of the original community is compromised with an increase of early-successional species and a decrease of old-growth dependent species which are unable to persist in small isolated patches of habitat (Noss 1983). Edge effect, the influence of the adjacent nonforest environment on forest structure and species composition at created edges, increases with increasing fragmentation of blocks of old-growth forest. The altered habitat associated with edges may contribute to old-growth forest degradation and to the loss of biodiversity in the fragmented landscapes (Gason et al. 2000, Laurence et al. 2002, Saunders et al. 1991). To conserve biological diversity it is believed that the uncut patches must have connectivity between them, based on the principles of landscape ecology (Forest Plan FEIS Appendix N; USDA FS 1997b).

Old-growth habitat reserves (OGRs) are categorized as large, medium, or small reserves. The Forest Plan includes direction to maintain connectivity between medium and large old-growth reserves. Small old-growth reserves (small OGRs) are the only category of OGR in the Tuxekan project area (Figure 3-8).

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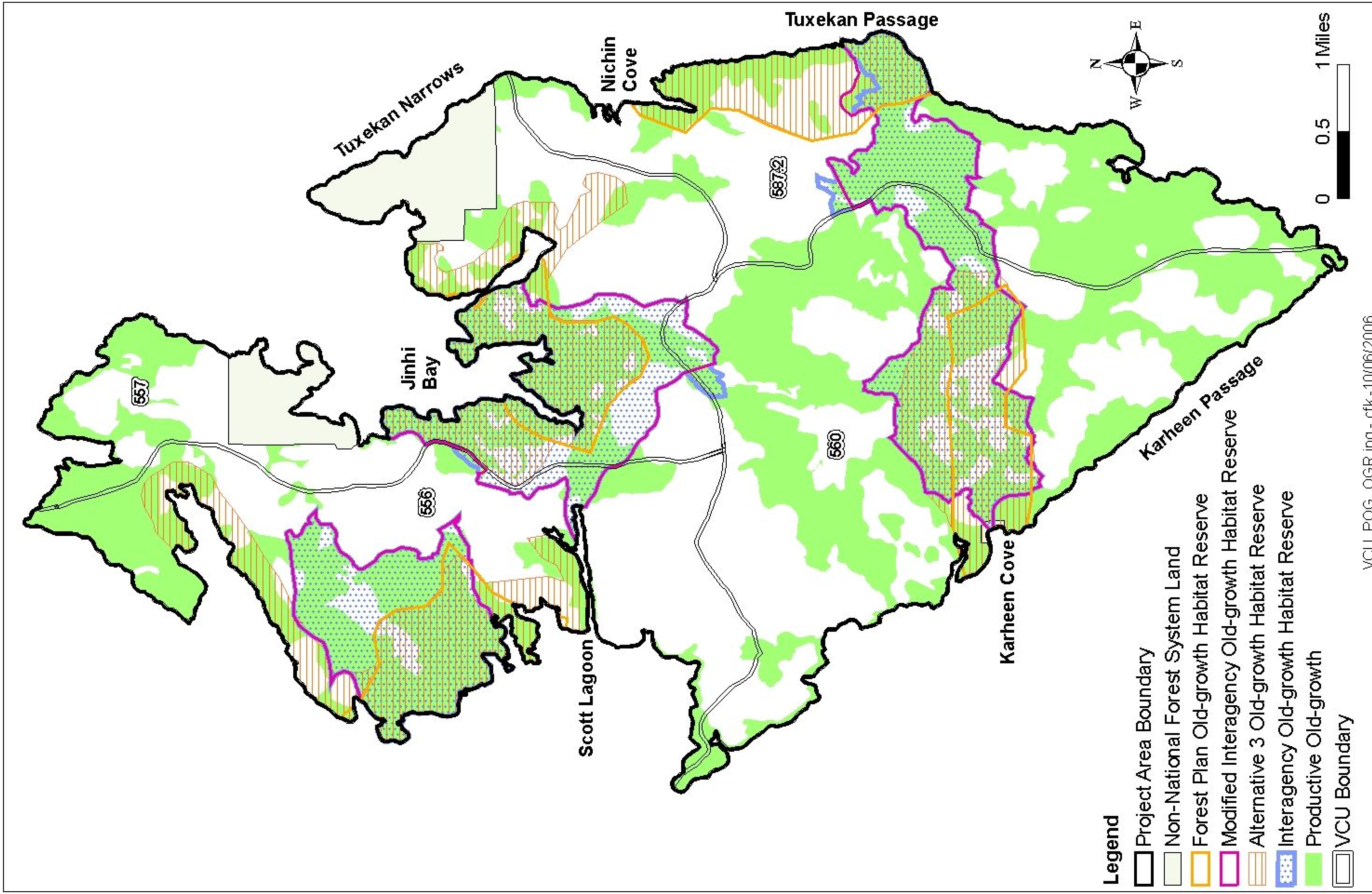

Figure 3-8. Project area VCUs, OGRs, and Productive Old Growth

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The analysis areas used for the biodiversity analysis include Value Comparison Units (VCUs); the project area, which is Tuxekan Island; and the analysis area, which are the NFS lands on Tuxekan Island. VCUs were used to identify the size of OGRs needed, and to analyze consistency with Forest Plan direction. Other analysis areas were used as noted, to address habitat conditions on Tuxekan Island.

The small old-growth reserves in the four VCUs within the project area were reviewed by an interagency group of biologists from the Forest Service, Fish and Wildlife Service and ADF&G in 1999 (Brockmann et al, 2000).Forest Plan design criteria for small old-growth reserves were reviewed to assess conditions of small OGRs as currently mapped in the Forest Plan.

Old-growth Habitat Reserve Criteria –Specific Design Criteria for Small Reserves

Small reserves are required in all VCUs except as noted below. When needed, small reserves shall be 16 percent of the area of a VCU and at least 50 percent of that size shall be productive old-growth forest. The preferred biological objective is for each reserve to contain at least 800 acres of contiguous productive old-growth forest, but may contain a minimum of 400 acres of productive old-growth forest.

Additional criteria for assessing the need for and designing of small reserves:

1. VCUs that have been separated (as denoted by decimal extensions, e.g., 587.1 and 587.2) may be combined for computation purposes. For this analysis, 587.1 and 587.2 were not combined, to be consistent with the Interagency OGR Review (Brockmann et al, 2000) and the OGR Review for Thorne Bay and Craig Ranger Districts (Brockmann et al, 2002).
2. In very large VCUs that contain relatively little old growth and the computational rule requires an amount of old growth that exceeds 50 percent of the existing old growth in the VCU, map a reserve of at least 800 acres of POG. This criterion does not apply to this project.
3. Small reserves are not required:
    a. In VCUs that already contain sufficient acres (16 percent/50 percent calculation) of productive old-growth forest in a non-development LUD.
    b. In VCUs with less than 800 acres of productive old-growth forest.

Neither 3a nor 3b above are applicable (they do not have sufficient acres and all have more than 800 acres of POG forest), and small OGRs are required for these four VCUs. Forest Plan direction is to have at least 16 percent of the area of the VCU in an OGR and at least 50 percent of the OGR as POG. All classes of POG are capable of growing trees at a rate of more than 20 cubic feet per acre per year. Productive old-growth forests can be further refined, based on the size and number of trees that the area is able to grow. High-volume old growth has the highest canopy cover. Understory production is moderate, but snow interception is high, making forage more available during the winter. In contrast, low-volume old growth is relatively open, understory is brushy, and thermal cover for wildlife is poor.

Coarse-structured (multi-aged, large trees) low elevation forest is important for several wildlife species including deer, goshawk, forest songbirds, and cavity nesters. Timber volume classes 6 and 7 (from the GIS cover existveg) are believed to be an adequate

predictor of those types of stands (Caouette et al. 2000). Acres of coarse-structured stands are shown in the Volume Class section.

The following discussion on the existing condition of the existing OGRs is summarized from Brockman et al (2000), and an OGR Review for Thorne Bay and Craig Ranger Districts (Brockman et al, 2002), and updated acreage information based on current GIS information.

VCU 556

VCU 556 encompasses the northwest corner of Tuxekan Island and several other nearby islands to the north and west. The largest of these islands are El Capitan, Cape North, and San Islands. Much of the VCU, on Tuxekan and the adjacent islands, has been logged, most of it during the 1960s and 1970s. Some comparatively smaller areas have been harvested before the 1960s and after the 1970s. There are 2,025 acres of previously harvested land in VCU 556 in the analysis area (NFS land on Tuxekan). Nearly all of the remaining forest stands in the VCU on Tuxekan Island appear to be medium and high volume strata old growth. The Forest Plan mapped OGR consists of essentially all of the medium volume strata within this VCU on Tuxekan Island, plus the adjacent high volume beach fringe. The current OGR (588 acres) is 325 acres deficient of the required minimum of 913 acres, but exceeds POG requirements by 75 acres (see Table 3-43 and Table 3-44).

VCU 557

VCU 557 covers the northeast quarter of Tuxekan Island, a few small islands adjacent to Tuxekan, and the adjacent shoreline of Prince of Wales Island. Forest stands in VCU 557 are fragmented by timber harvesting dating to every decade since the 1940s. There are 2,316 acres of previously harvested land in VCU 557 in the analysis area. Remaining old-growth stands are concentrated near the head of Jinhi Bay, with smaller, isolated stands in the north and south ends of the VCU. The existing OGR, as mapped in the Forest Plan, includes a mix of low, medium, and high volume strata old-growth forest, with small inclusions of non-commercial scrub or non-forested openings. The reserve (587 acres) is 548 acres deficient of the required minimum of 1,135 acres. It is also deficient by 52 acres of the required 567 acres of POG (see Table 3-43 and Table 3-44).

VCU 560

Forest habitat in VCU 560, on the southwest corner of Tuxekan Island, is highly fragmented by past timber harvest. A range of second-growth ages is present, with harvesting occurring during every decade since the 1930s. There are 2,412 acres of previously harvested land in VCU 560 in the analysis area. The small OGR, as mapped in the Forest Plan, includes a portion of the Karheen Lakes system, which supports substantial runs of sockeye, coho, and pink salmon. Terrestrial habitat includes primarily muskeg, non-commercial forest, and low-volume forest. Small inclusions of high-volume forest are restricted to north-facing slopes along the southern edge of the OGR. As originally mapped, the OGR is 627 acres, 314 acres deficient of the 941 acres needed to meet the minimum required acres, and it is 41 acres deficient in POG (see Table 3-43 and Table 3-44).

VCU 587.2

Much of the forest in VCU 587.2, the Southeast section of Tuxekan Island, was harvested in the 1960s and 1980s, with comparatively smaller amounts harvested in the 1940s and 1970s.

There are 1,090 acres of previously harvested land in VCU 587.2 in the analysis area. Remaining old-growth blocks are primarily restricted to the beach fringe and a few larger stands in the southern half of the VCU. The currently mapped OGR is a mix of non-forested muskeg, non-commercial scrub forest, and low to medium volume beach fringe and riparian forest. The OGR is 656 acres and contains 420 acres of POG. Most of the 420 acres of the POG (95 percent) is within linear beach and riparian buffers, rather than in a circular block as recommended in the Forest Plan (Rule B). Included within the OGR is the outlet stream of a lake system that supports sockeye, coho, and pink salmon. The existing OGR exceeds the minimum size criteria of 515 acres by 141 acres, and the minimum POG criteria of 400 by 20 acres, but does not appear to effectively protect remaining stands that provide interior forest conditions based on Rule D4 of Appendix K to the Forest Plan (see Table 3-43 and Table 3-44).

Old-growth Reserve Acres

Small old-growth reserves are required in most VCUs. Where they are required, they shall be 16 percent of the area of the VCU. As is shown in Table 3-43, three of the small OGRs in VCUs 556, 557 and 560 do not meet this direction as currently mapped.

Table 3-43. Existing Small OGR acres

VCU	Total Acres in VCU[a]	Minimum acres of OGR required by Forest Plan	Existing OGR Acres	Percent of VCU in OGR
556	5,704	913	588	10
557	7,091	1,135	587	8
560	5,884	941	627	11
587.2	3,218	515	656	20

[a] Total acres in VCU based on GIS VCU layer minus salt/freshwater and other lands

Productive Old-growth Forests

Old-growth forests typically contain some proportion of trees greater than 250 years old and include trees of other ages, sizes, and conditions, including dead standing trees (snags) and trees with dead tops.

Old-growth forests can be divided into a productive and an unproductive component, based on the ability of specific areas to grow trees of a certain size. All classes of POG are capable of growing trees at a rate of more than 20 cubic feet per acre per year. Forest Plan direction is to have at least 50 percent of the OGR as POG. The amount of productive old-growth forest in the OGRs is displayed in Table 3-44. As is shown, two of the OGRs do not meet Forest Plan direction.

Table 3-44. Existing Productive Old-growth Forest in Small OGRs

VCU	Minimum Small OGR acres required	Minimum acres of POG required	Existing acres of POG in Small OGR	Percent POG
556	913	456	531	58
557	1,135	567	515	45
560	941	470	429	46
587.2	515	400	420	82

Computationally, 587.2 only needs 257 acres of POG, but Appendix K states that they should be a minimum of 400 acres

Productive old-growth forests can be further refined, based on the size and number of trees that the area is able to grow. High-volume old growth has the highest canopy cover. Understory production is moderate, but snow interception is high, making forage more available during the winter. In contrast, low-volume old growth is relatively open, understory is brushy, and thermal cover for wildlife is poor. Table 3-45 shows the amount of POG, based on volume strata for the analysis area (NFS lands on Tuxekan). The high volume acres include non-hydric volume class 5 timber as well as volume class 6 and 7.

Table 3-45. POG by volume strata in the analysis area

Volume strata	Acres
High	6,316
Medium	1,832
Low	510
Total	**8,658**

Based on volstrata GIS layer, high includes non-hydric VC5 as well as VC 6 and VC7

Volume Class

Coarse-structured (multi-aged, large trees) low elevation forest is important for several wildlife species including deer, goshawk, forest songbirds, and cavity nesters. Timber volume classes 6 and 7 (from the GIS cover existveg) are believed to be an adequate predictor of those types of stands (Caouette et al. 2000). There are 339 acres of volume class 6 and volume class 7 (seven percent of the total (5,048) 6 and 7) in the existing OGRs. The analysis area contains a total of 5,048 acres of volume class 6 and 7 stands, as shown in Table 3-46.

Table 3-46. Coarse-structured stands in the analysis area

Volume Class	Acres
VC 6	2,580
VC 7	2,468
Total	**5,048**

Based on Volume class in existing_veg

Habitat Connectivity Affected Environment

The connectivity, or habitat corridors, between habitat blocks in a landscape may be at least as significant for maintaining diversity as the size of the blocks (Noss 1983). Low-elevation passes, beach fringe, and stream corridors provide natural connections between forested blocks and are important areas for migrating and dispersing wildlife. Corridors can function in different ways, depending on width and other characteristics. Corridor width can be important because some forest interior species do not live in, or even migrate through, extensive lengths of unsuitable habitat (Forman and Godron 1981).

There is no Forest Plan requirement to ensure connectivity among all small old-growth reserves or between small reserves and non-development LUDs including medium and large reserves. Productive old-growth forest within other areas (e.g. beach fringe, riparian, other non-development LUDs) contributes to overall landscape connectivity (TPIT 1998).

In the analysis area, connectivity along riparian areas, beach fringe, and between habitats at different elevations has been reduced by clearcutting within the watersheds. Approximately 419 acres or 21 percent of the total riparian management area was harvested prior to 1990. In addition, there have been 1,730 acres of beach/estuary buffer harvested prior to 1990, mostly on the western shoreline. Previously harvested areas are developing into second growth stands of similar age and composition.

The main dispersal corridors throughout the analysis area are most likely along major creeks, mountain passes, and near the beach. The principal stream corridors are Karheen Creek (east-west), the north fork of Karheen Creek (north-south), and two east-west creeks near Scott Lagoon on the western coast. Only a part of the Karheen Creek corridor (east-west) is included in the small OGRs as currently mapped. Portions of each of these corridors have been affected to some degree by previous harvesting. Existing small OGRs, major riparian corridors and past harvest (second growth) are shown on, the map for Alternative 1 in Chapter 2.

Biodiversity (OGRs and Connectivity) Mitigation Measures

- Improve size and composition of small old-growth reserves to meet Forest Plan direction, and implement riparian and beach/estuary buffers to maintain connectivity.
- The single-tree selection (STS) units would have less than 25 percent of the unit basal designated for harvest. The residual canopy, along with the regeneration would result in a mosaic of multiple age classes, maintaining forested structure for connectivity.

Old-growth Reserves Direct / Indirect Effects

The Forest Plan includes specific criteria for designing and locating small, medium, and large old-growth habitat reserves (Forest Plan, Appendix K; Forest Plan Clarification Letter (USDA FS 1998)). The small OGRs identified and mapped for the Forest Plan are anticipated to be reviewed during project-level planning (for projects areas that include or are adjacent to mapped old-growth habitat reserves (Forest Plan p. 3-80)), and are subject to change to improve their functioning in the overall reserve system (Forest Plan, Appendix K; USDA FS 1998).

An Interagency group of biologists met and reviewed the small OGRs in the four VCUs in the project area. The Forest Plan design criteria for small OGRs was reviewed and recommendations to existing OGRs were made reviewed and existing small OGRs were modified to address this recommendation (Brockman et al, 2000). Three of the Forest Plan mapped small OGRs, the ones in VCUs 556, 557 and 560, did not meet the minimum Forest Plan acreage requirements. In these three VCUs, the opportunity to meet the intent and requirements for small OGRs was limited by past harvesting. In those cases, consensus was reached without an on-site visit. The small OGR, as currently mapped in the Forest Plan, in VCU 587.2 exceeds the minimum acreage requirement. In VCU 587.2, large enough blocks of old growth still existed to allow consideration of more than one option for modification, and this area was field reviewed.

This group redrew the OGR boundaries, using features that could be located in the field, along with the Forest Plan criteria. As a result, the OGRs include some previously harvested areas and are larger than the minimum required acreages (see “Alternatives 4& 5 proposed OGR changes” in Table 3-47).

In May 2002, the results and recommendations from reviews of the OGRs for most of the Thorne Bay and Craig Ranger Districts were compiled (Brockman et al, 2002). This review incorporated the results from the 1999 review of the small OGRs on Tuxekan Island (in Brockman et al, 2000). These recommendations offer the best potential for protecting old-growth habitats. The Interagency recommendations for small OGRs have been fully incorporated into Alternatives 4 and 5. Alternative 2 includes slight modifications to the interagency small OGR recommendation to meet other resource considerations. Alternative 3 includes more modifications than Alternative 2 but still meets Forest Plan direction for size and composition of small OGRs. These changes are described in the following alternative descriptions and are displayed in Table 3-47.

Table 3-47. Proposed OGR changes by Alternative

VCU	Forest Plan min. total acres	Forest Plan mapped total ac.	+/-	Proposed total acres	+/- over min.	Forest Plan min. POG acres	Forest Plan mapped POG acres	+/-	Proposed POG acres	+/- over min.
Alternative 2 proposed OGR changes										
556	913	588	-325	1,115	+202	456	531	+75	932	+476
557	1,135	587	-548	1,128	-7	567	515	-52	806	+239
560	941	627	-314	1,133	+192	470	429	-41	834	+364
587.2	515	656	+141	537	+22	400	420	+20	511	+111
Alternative 3 proposed OGR changes										
556	913	588	-325	1,091	+178	456	531	+75	803	+347
557	1,135	587	-548	1,144	+9	567	515	-52	798	+231
560	941	627	-314	1,021	+80	470	429	-41	734	+264
587.2	515	656	+141	678	+163	400	420	+20	416	+16
Alternatives 4 & 5 proposed OGR changes										
556	913	588	-325	1,124	+211	456	531	+75	941	+485
557	1,135	587	-548	1,133	-2	567	515	-52	811	+244
560	941	627	-314	1,153	+212	470	429	-41	854	+384
587.2	515	656	+141	531	+16	400	420	+20	498	+98

Table 3-48 shows how each alternative compares to Forest Plan minimum requirements for the size of OGRs and amount of POG in each OGR. Alternative maps in Chapter 2 display the small OGRs

Table 3-48. Percent Small OGR and POG by VCU (measures 3aW1 and 3aW2)

VCU	Forest Plan minimum requirements	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Percent of VCU in small OGR (3aW1)						
556	16	10	19	19	20	20
557	16	8	16	16	16	16
560	16	11	19	17	19	19
587.2	16	20	17	21	17	17
Percent POG in small OGR (3aW2)						
556	50	58	83	74	84	84
557	50	45	71	70	71	71
560	50	46	74	72	74	74
587.2	50	82	95	61	94	94

Table 3-49 shows a comparison of the amount of POG over the analysis area after implementation of any of the alternatives. Effects of these changes are discussed for individual species, in the Wildlife section.

The interagency team felt that the protection of old-growth habitat in excess of the minimum required to meet Forest Plan direction is justified because of the disproportionate harvest that has occurred on the Craig and Thorne Bay Districts. These Districts are made up of island systems and the cumulative negative effects of habitat loss for old-growth dependent species are compounded and the risk of population isolation and extirpation is increased (Brockmann et al. 2002).

Table 3-49. POG in the analysis area after implementation of CCR harvesting (NFS lands on Tuxekan Island)

	1954[a]	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres POG	15,893	8,633	8,271	8,142	8,349	8,188
Percent change From existing	+54	0	-4%	-6%	-3%	-5%

[a] Estimate for 1954 is based on harvest by decade, to 1950. Assumed that all previous harvest was POG.

Table 3-50 displays how the alternatives affect coarse-structured forest (volume class 6 and 7) for the project area. Effects of these changes are discussed for individual species, where appropriate.

Table 3-51 shows the acres of coarse-structured (volume class 6 and 7) forest in the small OGRs, for each alternative. Alternative 3 doubles the acreage of coarse-structured stands

protected in small OGRs, while Alternatives 2, 4 and 5 provides more than four times the acreage protected in small OGRs.

Table 3-50. Volume class in the analysis area (NFS lands on Tuxekan Island)

Alternative	Alt 1 (acres)	Alt 2 (acres)	Alt 3 (acres)	Alt 4 (acres)	Alt 5 (acres)
VC6	2,580	2,447	2,351	2,464	2,397
VC7	2,468	2,265	2,238	2,286	2,238
Total	**5,048**	**4,712**	**4,589**	**4,750**	**4,635**
Percent change from existing	NA	-7	-9	-6	-8

Table 3-51. Coarse-structured stands in OGRs by alternative

	Alt 1 (acres)	Alts 2, 4 & 5 (acres)	Alt 3 (acres)
Volume Class 6 & 7	339	1,493	772

Old-growth Reserves Direct / Indirect Effects Specific to Alternative 1

Alternative 1 would result in no changes to existing old-growth or second-growth forests and connectivity in the analysis area. The small OGRs would remain as currently mapped. As discussed previously, three of the four reserves do not currently meet Forest Plan minimum requirements. There are currently 3,736 acres of suitable and available timber on NFS lands on Tuxekan.

There is a minimal amount of road (approximately 300 feet) in the existing small OGRs as currently mapped. This is a main road and would be remain open with implementation of this alternative. There would continue to be edge effects associated with the existing right-of-way and the potential loss of roadside trees to windthrow.

Old-growth Reserves Direct / Indirect Effects Common to Alternatives 2, 4, and 5

There are currently a total of 5.6 miles of open, drivable roads in the four proposed interagency recommended small OGRs, with another one mile of non-drivable road, for a total of 6.6 miles of roads. No temporary roads or new NFS roads are proposed in any of the small OGRs under any of the alternatives. After implementation of the proposed Access Management Plan (common to all alternatives) there would be a total of 3.7 miles of open, drivable roads, 0.1 miles would be storm-proofed, and the additional 2.8 miles of road would be put into storage. The 3.7 miles of road left open and drivable (roads 1470000 and roads 1460000) are the main roads providing access to the north and south ends of the island.

Whether the roads are left open, storm-proofed or put into storage, there would continue to be edge effects associated with the existing right-of-way and the potential loss of roadside trees to windthrow. Over the total 6.6 miles of road in the small OGRs, the majority is through mature to old stands, with only about a mile through second growth stands. There

would not be any increase in edge effects associated with roads in OGRs if any of the alternatives were implemented small OGRs. Over the long-term, roads put into storage would be expected to re-vegetate, first with alder. Over the very long-term, edge effects and risk of loss to windthrow would decrease as shrub and forested vegetation becomes established on the roadbed.

Table 3-48 shows how the alternatives numerically address Forest Plan direction. The size, boundary, and composition of the small OGRs vary by alternative, as discussed in the narrative section below. All action alternatives include some degree of proposed harvesting adjacent to the small OGRs (see alternative maps in Chapter 2). Disturbance during harvesting of these units may affect species using the small OGR, but would not affect the small OGRs themselves. Windthrow buffers have been designed to minimize the effects of windthrow, so there should be minimal effect from units immediately adjacent to the small OGRs.

Old-growth Reserves Direct / Indirect Effects Specific to Alternative 2

Alternative 2 would have a moderate effect on forest fragmentation because of the limited amount of harvesting and road building. Harvesting is deferred (not selected for harvesting at this time) from many units adjacent to RMAs, which helps to protect existing wildlife corridors. The boundaries of the four small OGRs in the project area would be adjusted according to the interagency committee’s recommendations with minor revisions of the interagency small OGRs in VCUs 557 and 587.2 to accommodate harvesting in Unit 560-406 and a reserve area in Unit 560-428. The map for Alternative 2 in Chapter 2 shows the proposed adjustments. Under this alternative, there would be approximately 2,850 acres of suitable and available timber on NFS lands on Tuxekan.

The boundaries of the small OGR in VCU 556 would be extended to the south to include the south-facing slopes of the major drainage that transects the existing small OGR. The adjusted small OGR would also include a smaller drainage, resulting in the protection of most of the high-quality deer wintering habitat, most of the potential goshawk and murrelet high value habitat, and most of the largest remaining block of contiguous old growth in this VCU. The adjusted small OGR would be increased from 588 to 1,115 acres, increasing POG from 531 to 932 acres and would exceed Forest Plan minimum requirements

The small OGR in VCU 557 would be modified in four directions. It would be extended south into VCU 560 to protect an old-growth corridor to the north fork of Karheen Creek; west into VCU 556 to protect a similar corridor to Scott Lagoon; north along the west shore of Jinhi Bay to include adjacent, low-elevation old-growth, and southeast to include remaining forest habitat between the existing small OGR and regenerating clearcuts. This configuration protects existing corridors and most of the remaining winter habitat for deer in the VCU and a known marbled murrelet nest, as well as the best potential goshawk-nesting habitat in the VCU. Approximately 196 acres in the recommended small OGR are mapped in adjacent VCUs (556 and 560), in order to achieve old-growth reserve objectives. Allocation of up to 30 percent of a small reserve in an adjacent VCU is allowed under Design Criteria B.4 (Forest Plan, Appendix K), where VCU boundaries do not match watershed or ecological boundaries. Application of this rule is justified, in this case, by the level of past harvesting in VCU 557, and the resulting cumulative effects. The adjusted small OGR would be increased from 587 to 1,128 acres, increasing POG from 567 to 806 acres and would exceed Forest Plan minimum requirements. The boundary for this small OGR was modified slightly from

the Interagency Recommendation to allow harvest in unit 560-406, in the adjacent VCU (less than 10 acres difference).

The interagency committee's recommendation for the small OGR in VCU 560 is that the existing small OGR should be expanded:

- To the north, to include high-volume, south-facing forest stands to the north Karheen Lakes; and
- To the east, to include a forested corridor to the low-elevation pass between the east fork of Karheen Creek and the large lake in VCU 587.2.

Additions would improve compliance with small reserve criteria by protecting high-quality habitat for wintering deer, and by including much of the largest remaining block of continuous old growth within the watershed. In addition, recent data indicates that the lakes are important wintering habitat for trumpeter swans (Brockman et al, 2002). The adjusted small OGR would be increased from 629 to 1,133 acres, increasing POG from 429 to 834 acres and would exceed Forest Plan minimum requirements. The recommended OGR boundary follows watersheds, streams, roads, and clearcut edges, as shown on Figure 2-2 in Chapter 2.

The existing small OGR in VCU 587.2 exceeds the minimum size criteria, and the minimum POG criteria, but does not appear to effectively protect remaining stands that provide interior forest conditions. In addition, the existing small OGR does not protect existing corridors between remaining old-growth blocks. The interagency committee's recommendation is that the existing small OGR should be moved to the south, extending south from the lake and stream along the western boundary of the VCU to a series of cuts and roads to the south, as shown on Figure 2-2 in Chapter 2. This adjustment would help protect the largest remaining block of old-growth habitat in the VCU, a stand that provides good deer wintering habitat. The resulting small OGR would be 537 total acres with 511 acres of POG and would meet Forest Plan requirements. Much of the western boundary would meet and form a contiguous reserve with the OGR in VCU 560 near the head of the east fork of Karheen Creek. The boundary of this small OGR was modified slightly as compared to Alt 4 to accommodate a reserve area in Unit 560-428 in the adjacent VCU (less than 10 acres decrease).

Old-growth Reserves Direct / Indirect Effects Specific to Alternative 3

Alternative 3 would have the greatest effect on fragmentation of the landscape because harvesting would occur across a greater amount of the interior of the island. Alternative 3 would also have the most acres of created openings, because, not only would more overall acres be affected, a higher proportion of those acres would be harvested using CCR (86 percent).

The boundaries of the four small OGRs in the project area would be adjusted in limited ways to include additional old-growth stands and high-value deer winter range, and to meet Forest Plan acreage requirements. Figure 2-3 in Chapter 2 shows the proposed adjustments. Under this alternative, there would be 3,443 acres of suitable timber land on NFS lands on Tuxekan.

The small OGR in VCU 556 would be increased from the currently mapped 588 acres to 1,091 acres, increasing the mapped POG from 531 acres to 803 acres. This reserve would be extended to the north and south and would incorporate the beach fringe buffer. The boundary is more linear than circular and less interior forest habitat is provided with this arrangement.

The adjustment would exceed Forest Plan requirements and retain some of the important deer winter range.

The small OGR in VCU 557 would be adjusted from 587 acres, with 518 of those acres in POG, to 1,144 acres, with 798 acres of POG. This small OGR would exceed Forest Plan minimum standards. The reserve would be expanded to include two large lakes near Jinhi Bay and the beach fringe along the bay. The boundary is more linear than circular. Less interior forest habitat is provided but important habitat around the two large lakes is included.

The small OGR in VCU 560 would be expanded to include two lakes and the lower watershed reaches, as well as maintaining the connection to the beach fringe. The reserve includes south facing winter range as well as important habitat around the lakes. The small OGR would increase from 627 to 1,021 acres. POG within the small OGR would increase from 429 to 734 acres, more than the minimum POG requirement.

The small OGR in VCU 587.2 currently meets or exceeds the Forest Plan requirements and would not be adjusted in this alternative.

Even though the small OGRs are larger under this alternative, because of the location, there is a minimal amount of road (approximately 300 feet) in the existing OGRs as currently mapped (same as Alternative 1). This is a main road and would remain open with implementation of this alternative. There would continue to be edge effects associated with the existing right-of-way and the potential loss of roadside trees to windthrow.

Old-growth Reserves Direct / Indirect Effects Specific to Alternative 4

Several units were not included in Alternative 4 because of wildlife issues. These units were deferred to protect either a stand of high-volume old growth, high-value deer winter range, or an existing wildlife corridor. Alternative 4 would have a moderate effect on forest fragmentation because of the amount of timber harvesting and road building.

Alternative 4 would fully implement the interagency committee’s recommended boundary changes to all four small OGRs in the project area. The interagency committee recommendations represent the highest level of protection for old-growth forests that have been identified as providing high-quality wildlife habitat. In Alternative 4, units 560-406 and 560-428 would not be harvested and no revisions to the interagency recommendations are needed, as were done in Alternative 2. Figure 2-4 in Chapter 2 shows the proposed adjustments. Under this alternative, there would be 2,880 acres of suitable and available timber on NFS lands on Tuxekan.

Adjustments to the small OGR in VCU 556 would be the same as Alternative 2. The adjusted small OGR would be increased from 588 to 1,124 acres, increasing POG from 531 to 941 acres and would exceed Forest Plan minimum requirements.

The small OGR in VCU 557 would be modified per the interagency committee recommendations, as described in Alternative 2. Due to no harvesting in Unit 560-406, the adjusted small OGR would be slightly larger than in Alternative 2. The resulting small OGR would be increased from 587 to 1,133 acres, increasing POG from 518 to 811 acres and would exceed Forest Plan minimum requirements.

Adjustments to the small OGR in VCU 560 would be the same as in Alternative 2. The adjusted small OGR would be increased from 627 to 1,153 acres, increasing POG from 429 to 854 acres and would exceed Forest Plan minimum requirements.

The modifications to the OGR in 587.2 would follow the interagency committee recommendations as described in Alternative 2, but would not be modified to include the reserve area of unit 560-428. The resulting small OGR would be 531 total acres with 498 acres of POG and would meet Forest Plan requirements.

Old-growth Reserves Direct / Indirect Effects Specific to Alternative 5

Alternative 5 would fully implement the interagency committee's recommended boundary changes to all small OGRs in the project area (similar to Alternative 4). The interagency committee recommendations represent the highest level of protection for old-growth forests that have been identified as providing high-quality wildlife habitat. In Alternative 5, unit 560-406 would not be harvested and no revisions to the interagency recommendations are needed. Figure 2-5 in Chapter 2 shows the proposed adjustments. Under this alternative there would be 2,880 acres of suitable and available timber on NFS lands on Tuxekan.

Adjustments to the small OGR in VCU 556 would be the same as Alternative 2. The adjusted small OGR would be increased from 588 to 1,124 acres, increasing POG from 531 to 941 acres and would exceed Forest Plan minimum requirements.

The small OGR in VCU 557 would be modified per the interagency committee recommendations, as described in Alternative 2. Due to no harvesting in Unit 560-406, the adjusted small OGR would be slightly larger than in Alternative 2. The resulting small OGR would be increased from 587 to 1,133 acres, increasing POG from 518 to 811 acres and would exceed Forest Plan minimum requirements.

Adjustments to the small OGR in VCU 560 would be the same as in Alternative 2. The adjusted small OGR would be increased from 627 to 1,153 acres, increasing POG from 429 to 854 acres and would exceed Forest Plan minimum requirements.

The modifications to the OGR in 587.2 would follow the interagency committee recommendations as described in Alternative 2, but would not be modified to include the reserve area of unit 560-428. The resulting small OGR would be 531 total acres with 498 acres of POG and would meet Forest Plan requirements.

Habitat Connectivity Direct / Indirect Effects (measure 3aW3)

Existing wildlife corridors in the analysis area would be affected to varying degrees by the location of proposed harvest units in the alternatives. The Forest Plan contains requirements for maintaining landscape connectivity between large and medium small OGRs. However, Tongass Plan Implementation Team (TPIT) Policy Clarification (USDA FS 1998) details that there is no requirement to ensure connectivity among all small reserves or between small reserves and non-development LUDs, including large and medium reserves. This is because productive old-growth forest occurring within the beach fringe, riparian areas, and other unavailable timber lands contributes to overall landscape connectivity. The direction for beach and estuary connectivity states that where these features do not provide sufficient POG forest connectivity to meet the objectives, additional POG beyond the buffer may be needed to meet the intent of the strategy.

Landscape connectivity and wildlife corridors were evaluated during Tuxekan Project planning, despite no requirement for maintaining habitat connectivity between the four small reserves in the project area. This was because of past harvest the beach fringe and riparian areas. In some alternatives, efforts were made to avoid harvesting in certain proposed units

that appeared to disrupt an existing corridor. Continuous patches of high- or medium-volume strata old-growth forest, topographical changes, and the absence of young second-growth stands identified wildlife corridors. Areas that likely act as current wildlife corridors are identified in the Affected Environment section and in Figure 2-1 in Chapter 2, which depicts existing conditions in the project area and Alternative 1 – No Action.

There are few miles of proposed, NFS, or temporary roads in the identified corridors under any alternative. There are no proposed roads in the Scott Lagoon area. On the major corridor, along the North Fork Karheen Creek, no new road is proposed on the west side under any alternative. On the east side, there is a short section of proposed NFS road in unit 560-411, but it would be uphill of the riparian corridor. On the secondary corridor between small OGRs in 5570 and 5870, there are short sections of proposed NFS road or temporary road in all alternatives. These could introduce edge effects and increased chance of loss of trees to windthrow.

Effects analyses here are general effects to mature and old forest stands in existing corridors. Effects on individual species potentially using these corridors are addressed later in the document. Since there would be no new edge effects in any of the small OGRs, and effects are not limited to corridors and connectivity, they will be addressed in the Biological Environment section of this document for potential effects to individual species.

Habitat Connectivity Direct / Indirect Effects Specific to Alternative 1 – No Action

Connectivity would be maintained as described under the Affected Environment section.

Habitat Connectivity Direct / Indirect Effects Common to all Action Alternatives

All action alternatives include the use of both STS and CCR prescriptions. The STS prescription would retain more than 50 percent of the existing canopy in the unit. Regeneration would be expected in the gaps, resulting in a stand that is a mosaic of multiple age classes. These units would maintain structural features needed to maintain connectivity for most species. The harvested portion of the CCR units would result in a two-aged stand, with approximately 10 percent of the original stand structure retained. The harvested areas would not be suitable to maintain connectivity for many wildlife species. However, the reserve/deferred areas of the CCR units would retain their current stand structure and contribution to connectivity. Where units are proposed in identified corridors, they are addressed in the narrative below.

Habitat Connectivity Direct / Indirect Effects Specific to Alternative 2

In Alternative 2, connectivity between the small OGRs is maintained through deferring harvesting in several units where there were watershed, soil, or karst concerns.

Connectivity between the small OGRs in VCU 560 and 587.2 would be provided by a continuous east-west corridor of high and medium volume old-growth forest extending along Karheen Creek east toward Kugun Point. The east side of the north fork of Karheen Creek provides a north-south corridor between the small OGR in VCU 557 and the OGR in VCU 560. In all alternatives, one of the reasons for designating unit 560-412 (on the east side of the north fork) as a STS with reserve areas was to reduce changes in stand structure along the

north-south corridor in the middle of the island. Harvesting of unit 560-406 on the west side of the East Fork of the North Fork Karheen is planned as a CCR and would remove the existing mature forested cover in the corridor. This could potentially affect movements of several species of wildlife on the west side of the lake. Movements would be restricted to the riparian/lakeshore buffer or second growth and deferred/reserved area upslope from the unit.

For both Alternatives 2 and 3, CCR harvesting in portions of units 560-405, 560-428 and 587.2-424 would disrupt connectivity on the secondary corridor between small OGRs in VCUs 587.2 and 557. Connectivity would be maintained between small OGRs in VCUs 587.2 and 560 due to the use of the interagency small OGR boundaries.

Two east-west creeks near Scott Lagoon on the western coast of Tuxekan Island provide marginal east west corridors between the small OGRs in VCUs 556 and 557. Several second-growth stands border these corridors, and mature/old forested stands are very narrow at the head of Scott Lagoon. There is no harvesting planned anywhere in the vicinity of these corridors in Alternative 2 as harvest in Units 556-412 and 557-433 is deferred and they would be maintained in their current condition. See Alternative 2 map in Chapter 2.

Habitat Connectivity Direct / Indirect Effects Specific to Alternative 3

Under Alternative 3, no entire units would be eliminated from harvesting to enhance existing connectivity and wildlife corridors between the small OGRs. Existing unharvested riparian areas, mountain passes, and the 1,000-foot beach fringe area provide current connectivity.

For both Alternatives 2 and 3, CCR harvesting in portions of units 560-405 and 560-428 would disrupt connectivity on the secondary corridor between small OGRs in VCUs 587.2 and 557. Existing connectivity is maintained between small OGRs in VCUs 587.2 to 560, as no units are located along the riparian corridors or low pass between them.

Three units affect connectivity between the small OGR in VCUs 560 and 557 to the north. In all alternatives, one of the reasons for designating unit 560-412 (on the east side of the North Fork Karkeen) as a STS with reserve areas was to reduce changes in stand structure along the north-south corridor in the middle of the island. Another unit 560-411 on the east side would have two small clearcuts with reserves (6 to 7 acres each), which would create small openings in the existing mature/old forest corridor. Harvesting of unit 560-406 on the west side of the east side of the North Fork Karheen is planned as a CCR and would remove the existing mature and old forested cover corridor. This could potentially affect movements of several species of wildlife on the west side of the lake. Movements would be restricted to the riparian/lakeshore buffer or second growth and deferred/reserved area upslope from the unit. See Alternative 3 map in Chapter 2.

Habitat Connectivity Direct / Indirect Effects Specific to Alternative 4

Alternative 4 incorporates the interagency small OGRs. Connectivity between the small OGRs in VCU 560 and 587.2 would be provided by a continuous east-west corridor of high and medium volume old-growth forest extending along Karheen Creek east toward Kugun Point. The east side of the North Fork Karheen Creek provides a north-south corridor between the small OGR in VCU 557 and the small OGR in VCU 560. In all alternatives, one of the reasons for designating unit 560-412 (on the east side of the north fork) as a STS with reserve areas was to reduce changes in stand structure along the north-south corridor in the middle of the island. Unit 560-411 on the east side would have two small clearcuts with reserves (6 to 7 acres each), which would create small openings in the existing mature/old

forest corridor. Unit 560-406 on the west side of the North Fork Karheen was dropped to maintain mature/old forested structure along the drainage and lake, maintaining the current corridor. Due to the prescriptions used on the east side of this major corridor, along with no harvesting on the west side of the corridor, connectivity would be maintained through the center of the island.

Because no harvesting would occur in unit 560-428, Alternative 4 maintains a narrow secondary corridor between units 587.2-424 and 560-405 for connectivity between the small OGRs in VCUs 587.2 to 557.

Two east-west creeks near Scott Lagoon on the western coast of Tuxekan Island provide marginal east west corridors between the OGRs in VCUs 556 and 557. Several second-growth stands border these corridors, and mature/old forested stands are very narrow at the head of Scott Lagoon. There is one unit (557-433) planned near the head of Scott Lagoon. However, it is planned for STS harvest. Other units to be harvested near this corridor are located further upslope, above the riparian corridor and are not expected to affect existing connectivity. See Alternative 4 map in Chapter 2.

Habitat Connectivity Direct / Indirect Effects Specific to Alternative 5

Alternative 5 incorporates the interagency small OGRs, as well as most of the units in Alternative 3. Two units were dropped to accommodate both the new OGR boundary and to address connectivity. Unit 556-452 was dropped for the small OGR boundary and 560-406 for connectivity.

CCR harvesting in portions of units 560-405 and 560-428 would disrupt connectivity on a secondary corridor between small OGRs in VCUs 587.2 and 557. Existing connectivity is maintained between small OGRs in VCUs 587.2 to 560.

Connectivity between the small OGR in 560 and 557 to the north is affected by two units. In all alternatives, one of the reasons for designating unit 560-412 (on the east side of the North Fork Karkeen) as a STS with reserve areas was to reduce changes in stand structure along the north-south corridor in the middle of the island. Another unit 560-411 on the east side would have two small clearcuts with reserves (6 to 7 acres each), which would create small openings in the existing mature/old forest corridor. Unit 560-406 on the west side of the east side of the North Fork Karheen was dropped to maintain the existing mature and old forested cover adjacent to the riparian and lake corridor. Due to the prescriptions used on the east side of this major corridor, along with no harvesting on the west side of the corridor, connectivity would be maintained through the center of the island. See Alternative 5 map in Chapter 2.

Biodiversity Cumulative Effects

The cumulative effects analysis area for small OGRs and for connectivity is the four VCUs within the Tuxekan Island project area. The effects of past timber harvesting was incorporated into the development of the Interagency OGR recommendation. In addition, the past harvesting was considered during the connectivity analysis. The following information will display more information on past timber harvest, as well as reasonably foreseeable future timber harvesting or timber management. Cumulative effects have been analyzed for the short-term (less than 10 years) and long-term (greater than10 years). Short-term effects result from changes to the existing condition as an immediate result of the proposed action,

whereas long-term effects are realized as the habitat changes over time from the directly effected condition.

There are approximately 836 acres of non-National Forest System lands on Tuxekan Island, in two areas (see Figure 3-8). The land on the west side of Jinhi Bay is dominated by second growth that was mostly harvested between the 1950s and 1970s. The other piece of land along Tuxekan Narrows has had a smaller proportion harvested, again mostly during the same time period. The State recently harvested an additional 100 acres out of this same area.

Timber harvesting on federal lands on Tuxekan Island began in 1920, and since that time, approximately 7,844 acres of old-growth forest has been harvested in the project area. Timber harvesting peaked in the 1960s and 1970s, declined during the 1980s, and continued at very low levels through the 1990s. Table 3-52 shows the acres of harvest by decade on Tuxekan Island.

Table 3-52. Past harvest acres on Tuxekan Island

Years of harvest	Acres Harvested
1920-1929	4
1930-1939	7
1940-1949	712
1950-1959	148
1960-1969	2,423
1970-1979	2,799
1980-1989	1,534
1990-1999	149
2000 to present	69
Total prior to Tux	**7,845**
Tuxekan Alts 2-5	381-573

Harvesting before the mid-1940s was focused on areas accessible from the beach (although not all in the beach fringe). The harvesting from the mid-1940s to the late 1970s was focused on the northern and central part of the island. Harvesting from the late 1970s through the early 1990s was mostly on the southern part of the island (Figure 3-4). Approximately 419 acres or 21 percent of the total riparian management area was harvested prior to 1990. In addition, there have been 1,730 acres of beach/estuary buffer harvested prior to 1990, mostly on the west side of the island.

There have been approximately 2,145 acres of precommercial thinning, which is usually done between 15 and 30 years after harvest. Most of this thinning was done in the 1980s and 1990s, generally to a 12x12 or 14x14 foot spacing. This includes the south side of Scott Lagoon, the beach buffer from Scott Lagoon south to Turn Point, beach buffer to the north of Peep Rock, and beach buffer at Nichin Cove, as well as along interior riparian corridors. Current precommercial thinning plans (King Tux) are to thin 1,291 acres of second growth. This is in stands harvested between 1973 and 1986 (roughly 20 to 30-year old stands), mostly on the southern end of the island. Ten percent of the thinning was targeted to improve wildlife habitat, one percent to improve riparian habitat and the rest for timber management.

As previously stated, the effects of past timber harvesting were incorporated into the development of the Interagency small OGR recommendation. In addition, the past harvesting was considered during the connectivity analysis (see Direct and Indirect Effects analysis above). The only foreseeable future action is timber management in previously harvested stands (pre-commercial thinning). Pre-commercial thinning could improve connectivity between stands and across the island over the long-term, but effects would not vary by alternative.

Biodiversity Cumulative Specific to Alternative 1

No cumulative effects would occur, as there is no overlap in time and space for effects occurring as a result of no action. Under this alternative, there would be 1,894 acres of productive old growth in the small OGRs.

Biodiversity Cumulative Specific to Alternative 2

The boundaries of the four small OGRs in the project area would be adjusted according to the interagency committee's recommendations, but minor revisions of the Interagency small OGRs in VCUs 557 and 587.2 would be made to accommodate harvesting in two small areas. Under this alternative, there would be 3,083 acres of productive old growth in the small OGRs.

Biodiversity Cumulative Specific to Alternative 3

The boundaries of the four small OGRs in the project area would be adjusted in limited ways to include additional old-growth stands and high-value deer winter range, and to meet Forest Plan acreage requirements. Under this alternative, there would be 2,751 acres of productive old growth in the small OGRs.

Biodiversity Cumulative Specific to Alternative 4

Alternative 4 would fully implement the interagency committee's recommended boundary changes to all four small OGRs in the project area. The interagency committee recommendations represent the highest level of protection for old-growth forests that have been identified as providing high-quality wildlife habitat. Under this alternative, there would be 3,104 acres of productive old growth in the small OGRs.

Biodiversity Cumulative Specific to Alternative 5

Alternative 5 would fully implement the interagency committee's recommended boundary changes to all four small OGRs in the project area. The interagency committee recommendations represent the highest level of protection for old-growth forests that have been identified as providing high-quality wildlife habitat. Under this alternative, there would be 3,104 acres of productive old growth in the small OGRs.

Deer Habitat and Subsistence Use

Deer Habitat and Subsistence Use Affected Environment

The winter availability of forage is the most limiting factor on Sitka black-tailed deer. The capability of winter habitat to support Sitka black-tailed deer is a function of forage

abundance and quality (Hanley et al. 1989), snow interception qualities of the overstory (Hanley and Rose 1987; Kirchhoff and Schoen 1987), and climate as influenced by aspect, elevation, and maritime conditions (Hanley and Rose 1987). Cleared areas and young second growth greatly exacerbate the impacts of deep-snow winters by providing little snow interception, thus burying the understory forage. Even in unlogged conditions, a deep-snow winter can result in relatively high deer mortality. Deer populations also respond to predation pressure and hunting mortality. Predation by wolves in particular is thought to significantly retard the recovery of the deer herd from mortality resulting from deep-snow winters. Demand for deer in the project area by humans may not be met after a deep snow winter.

The Tongass deer model is a GIS-based model that assigns habitat capability scores for winter habitat based on slope, aspect, snow level, and volume of forest stands. The Tongass deer model was used to identify existing high-value deer winter range in the analysis area. There are approximately 8,717 acres of high-quality deer habitat in the analysis area. Based on current direction, if deer habitat capability is used to determine effects on subsistence and wolves are present, a 36 percent reduction factor shall be incorporated. Results from the model show current habitat capability to be 819 deer. These numbers are based on total acres on the island, but assume no deer production from non-federal lands. When the model was run over the total acreage for WAA 1531, it showed a current habitat capability of 1,437 deer (see Table 3-54 and Table 3-55 deer model for project area and results for WAA).

Table 3-53. Deer harvesting by year for WAA 1531

Harvesting year	Number reported
1995	35
1996	9
1997	0
1998	20
1999	0
2000	50
2001	39
2002	10
2003	9
Average (not including the years with no data)	**24.5**

The Sitka black-tailed deer is by far the most important and most hunted terrestrial wildlife species for subsistence purposes and hunting (USDA FS 1997b). Biologists estimate that 10 percent of a population can be harvested at carrying capacity with the population remaining stable and hunter satisfaction remaining high (Suring et al. 1992b). Harvesting data are collected by the ADF&G and summarized by wildlife analysis area (WAA). The project area falls into ADF&G-designated WAA 1531, which also includes Marble Island and several islands in Sea Otter Sound. ADF&G-documented harvesting of deer from WAA 1531 is provided in Table 3-53. The declining harvest of deer and other wildlife can be partially attributed to the declining population, including hunters, of Edna Bay on Kosciusko Island and Naukati on Prince of Wales Island. In addition, most of the 7,500 acres of second-growth

forest in the Tuxekan analysis area (NFS lands) is currently in the stem exclusion phase of regeneration. (For additional discussion of the stem exclusion phase see the following Direct / Indirect Effects sections: Vegetation Management and Sitka Black-tailed Deer.) As discussed previously, this phase produces less forage for deer and therefore may also contribute to a decline in deer habitat capability.

Several communities rely on Tuxekan Island (WAA1531) for subsistence deer hunting, with 33 percent of all Edna Bay households reporting use between 1995 and 1999. Tuxekan Island was used for subsistence deer hunting by 20 percent of Naukati households, 16 percent of Coffman Cove households, and 13 percent of Whale Pass households (Turek 2001).

Deer Habitat and Subsistence Use Mitigation Measures

Forest Plan Standards and Guidelines were incorporated into alternatives as design criteria, as were additional protective measures (e.g., closure of temporary roads post-implementation).

Deer Habitat and Subsistence Use Direct / Indirect Effects

The Tongass deer model was one tool used to evaluate effects to winter habitat for deer. As noted previously, the deer model estimates the capability of habitats to support deer during winter and does not reflect actual populations in the project area. It is used as a tool to compare alternatives.

Results of the Tongass deer model are displayed in Table 3-54. To compare the direct and indirect effects of the alternatives, the model was run over the project area as this would more clearly display the difference between the alternatives. The model was then run over the WAA. In general, higher value habitat drops in quality when harvested and then drops again at stem exclusion stage. In contrast, lower value habitat may increase in value following harvesting because of increased forage, but values drop below pre-harvesting level once stem exclusion occurs (see USDA FS 1997b, pp. 3-365 thru 3-379 and USDA FS 1998 letter from Forest Supervisor for model details, outputs, and revisions (USDA FS 1998); for discussion on the limitations of the deer model, see section: Deer Abundance and Distribution below). Deer habitat capability has declined since timber harvesting began in the 1940s. The action alternatives would add to that decline. The results shown in Table 3-54 does include the 36 percent reduction to account for predation by wolves.

Table 3-54. Deer model results for the project area with predation[a]

	Year		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	1954	2005					
Deer habitat capability	1,372	819	796	779	773	781	775
Deer/sq mi	49	29	29	28	28	28	28

[a] Assumes 0 habitat capability from non-NFS lands

Where wolves are present, habitat scores are reduced by 36 percent to account for the influence of predation on the number of deer available to hunters. An analysis by ADF&G of pellet data suggests that pellet densities are 36 percent lower in areas that have wolves than those that do not. This correction factor applies only to determination of relative impacts in

human use of deer and not for determining the number of deer available to wolves. Effects of predation are included in Table 3-55 below. These numbers do include habitat capability from non-federal lands.

Table 3-55. Deer model results for WAA 1531 with predation[a] (measure 3bW1)

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Deer habitat capability	1,437	1,421	1,415	1,423	1,417
Deer/sq mi	26	26	25	26	25

[a] Assumes 0 habitat capability from non-NFS lands

Treatments proposed under all action alternatives would result in the reduction of habitat capability, as shown in Table 3-54and Table 3-55. The model is not sensitive enough to show a significant difference between the alternatives. However, theoretical deer densities would exceed the Forest Plan standard and guideline of 17 deer per square mile (Forest Plan Clarification Papers, 1998) and the recommended change to 18 deer per square mile (2000 Forest Plan Monitoring and Evaluation Report).

There are approximately 8,717 acres of high-quality deer habitat in the analysis area, as shown in Table 3-56. Alternative 4 would protect the most habitat with the full implementation of the interagency committee's recommendations for the small OGRs and the deferral of several units located in high-value deer habitat. Units deferred in this alternative include many that are located in existing wildlife corridors between the OGRs, as previously described. Deep snow winters are less frequent on the outer islands than elsewhere on the Tongass. However, demand for deer by humans may be harder to meet if a deep snow winter occurs. The relative ranking of alternatives with respect to the effects of a deep snow winter would be the same as described above for removal of high-value deer habitat.

Table 3-56. High-value deer habitat (measure 3bW2)

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres high-value deer habitat post project	8,717	8,302	8,177	8,360	8,224
Acres harvested	0	415	540	357	493
Percent change from existing	**NA**	**-5%**	**-7%**	**-4%**	**-6%**

Deer Abundance and Distribution

Declines in deer habitat capability (i.e. the number of deer available to humans) are measurable. The Tongass deer model is a GIS-based model that assigns habitat capability scores for winter habitat based on slope, aspect, snow level, and volume of forest stands. The model does have some limitations; it does not account for cultural treatments in young stands that postpone the stem exclusion phase, increase growth and diversity and effectively limit the duration of the stem exclusion phase, providing better habitat, forage, and more rapid stand development than untreated young stands. Additionally, effects of partial harvests are overstated because the model considers everything a clearcut. The Tongass deer model was

used to identify existing high-value deer winter range in the analysis area. There are approximately 8,717 acres of high-quality deer habitat in the analysis area. Results from the model show current habitat capability to be 819 deer in the project area (Table 3-55). Deer habitat capability in the project area has decreased due to timber harvesting between 1954 and now. In 1954 there were 13,660 acres of high value deer habitat in the analysis area.Under all alternatives, including the no action, deer habitat capability would continue to decrease as existing second-growth stands enter the stem exclusion stage. The model results may overestimate effects because approximately half of the previously harvested stands have had cultural treatments. Theoretical deer densities within and across the analysis area and WAA, on all lands regardless of ownership, or predation would exceed the Forest Plan Standard and Guideline of 17 deer per square mile (and the recommended change to 18 deer per square mile) (see Table 3-54 and Table 3-55, Table 3-58, and Table 3-59). According to these tables the lowest predicted value for deer densities is on Table 3-58 which shows 23 deer per square mile in all alternatives with predation by the year 2054.

The distribution of deer would change in response to habitat capability. Once second growth stands reach the stem exclusion stage, these stands would not support the number of deer that were supported prior to harvesting due to lack of understory browse. As deer become harder to find, competition between rural and non-rural hunters could increase.

Over the short-term, deer may avoid some CCR and STS harvested stands due to treatment activities and post-treatment slash depth. Indirectly, increased forage production in treated stands should help to maintain deer populations in the short-term by providing summer forage. Once treated areas reach the stem exclusion stage they would not function as suitable deer habitat until at least 100 years post harvest, or unless another thinning treatment occurs. Windfirm buffers are built in during unit layout, and barriers to movement caused by windthrow are not expected to be significant.

The construction of proposed temporary and NFS roads would have short-term effects (less than 10 years) to deer by increasing the possibility of mortality due to hunting. Table 3-57 shows the open road densities and total road densities (includes both NFS and temporary roads), both during project activities, and after implementation of the Access Management Plan.

Table 3-57. Road densities during and post-project

Roads (density - mi/sq mi)	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
During project activities					
Total Road Density	2.2	2.5	2.6	2.4	2.6
Open Road Density	1.4	1.6	1.7	1.6	1.7
After implementation of Access Management Plan					
Total Road Density	2.2	2.3	2.4	2.4	2.4
Open Road Density	1.4	0.8	0.8	0.8	0.8

Note: Total road density after implementation does not include temporary roads that were decommissioned

All of the action alternatives may affect individuals through a reduction in habitat capability, temporary displacement, and a short-term increase in access to hunters.

Deer Habitat and Subsistence Use Cumulative Effects

The cumulative effects analysis area for deer and subsistence is WAA 1531 and Tuxekan Island. All past timber harvest, future timber harvesting and management, roads (both increase vulnerability to hunters and provide access to subsistence users) are considered.

There are approximately 836 acres of non-NFS lands on Tuxekan Island, in two areas. The land near Kwati Point is dominated by second growth that was mostly harvested between the 1950s and 1970s. The other piece of land along Tuxekan Narrows has had a smaller proportion harvested, again mostly during the same time period. The State recently harvested an additional 100 acres out of this same area. The Tongass deer model results shown below use Forest Plan assumption of no deer habitat capability for non-federal lands.

Table 3-58. Deer model results for the project area, including non-National Forest System lands but with no habitat capability after full implementation

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Deer habitat capability w/o predation	1,243	1,217	1,208	1,220	1,211
Deer/sq mi w/o predation	45	44	44	44	44
Deer habitat capability with predation	796	779	773	781	775
Deer/sq mi with predation	29	28	28	28	28

Timber harvesting on Tuxekan Island began in 1920, and since that time, approximately 7,857 acres of old-growth forest has been harvested in the project area. Most of these acres (7,785 acres) were harvested using a clearcut prescription. Timber harvesting peaked in the 1960s and 1970s, declined during the 1980s, and continued at very low levels through the 1990s. Harvesting to date has generally been by clearcutting of old-growth stands. There have been approximately 2,145 acres of pre-commercial thinning, which is usually done between 15 and 30 years after harvest. Most of this thinning was done in the 1980s and 1990s, generally to a 12x12 or 14x14 foot spacing. Current (FY05) precommercial thinning plans are to thin 1,291 acres of second growth.

Clearcut stands older than 25 years contribute only marginally to deer habitat capability because of lack of forage. These older clearcut stands enter into the stem exclusion phase approximately 26 years after harvesting and maintain those characteristics for 100 years or more. These factors were built into the deer model, so are already incorporated into the results (year 2054 - 100 years after large-scale logging began on the Tongass). Some replacement summer forage would be produced with commercial thinning second growth stands in the stem exclusion phase that are approximately 65 years old and precommercial thinning treatments which would postpone the onset of the stem exclusion stage (commercial and precommercial thinning are not proposed as a part of this project).

Table 3-59. Deer model cumulative effects results for WAA 1531, including non-NFS lands in 2054

Year 2054	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Deer habitat capability with reduction for predation	1,330	1,290	1,277	1,295	1,282
Deer/sq mi with reduction for predation	24	23	23	23	23

There are currently 58.8 miles of existing roads on National Forest System lands on Tuxekan Island. Of these existing roads, approximately 62 percent (37 miles) are open either to off-highway or high-clearance vehicles.

Deer Abundance and Distribution

Previous timber harvesting, and the resulting loss of habitat capability on Tuxekan has been extensive (there is second growth over approximately 44 percent of the Island). Any additional harvest, including this project, would result in an additional decrease in habitat capability. The direct effects of the alternatives do not present a significant possibility of restriction on subsistence uses of deer. However, competition for deer may increase after existing harvest units enter stem exclusion and habitat capability drops (Table 3-58).

Any of the action alternatives, in combination with past, present and future activities (precommercial thinning) may reduce the number of deer per square mile, but still meet the 17 deer per square mile recommended to meet hunting and wolf needs (Forest Plan Clarification Papers 1998) and the 18 deer per square mile recommended (2000 Monitoring and Evaluation Report). Based on the model, by the year 2054, deer would be reduced to 23 deer per square mile, but would still meet the above direction.

Subsistence

As in the analysis of Issue 3 – Wildlife, the analysis area for direct and indirect effects is Tuxekan Island, the analysis area for subsistence cumulative effects is WAA 1531, which encompasses the proposed project area and is used by the State of Alaska to collect survey data regarding wildlife harvests. The time frame considered extends to the expected onset of stem exclusion, approximately 2054, in order to evaluate the effects of the alternatives in concert with full Forest Plan implementation.

Subsistence Affected Environment

The following discussions and analysis are based on the detailed subsistence information and analysis in Chapter 3, Appendix H, and the Community Deer Harvest map located in the map packet of the Forest Plan (USDA FS 1997b). Conversations with State of Alaska game management personnel and residents familiar with subsistence activities in their community also provided information for this section. This section defines and describes existing community subsistence uses in the project area and the potential effects on subsistence use in those communities from the proposed actions. See also the discussion of the Wildlife Issue in

this chapter and the Fisheries Resources Section for additional analysis of fish, deer, and other wildlife species.

Alaska Native Interest Lands Conservation Act (ANILCA)

Subsistence is a broad term that applies to many uses of natural resources by rural Alaskans. In the Alaska National Interest Lands Conservation Act (ANILCA), subsistence is defined (in part) as “the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation” (ANILCA, Sec. 803). ANILCA provides for the continuation of these uses “consistent with sound management principles, and the conservation of healthy populations of fish and wildlife” (ANILCA, Sec. 802). It also legislates that “nonwasteful subsistence uses of fish and wildlife and other renewable resources shall be the priority consumptive uses of all such resources on the public lands of Alaska” (ANILCA, Sec. 802). For many rural Alaskans, subsistence is a way of life and carries cultural and religious meaning.

ANILCA requires the analysis of subsistence uses and resources on National Forest System land and of any potential effects resulting from management activities (ANILCA, Sec. 810). This analysis typically focuses on food-related resources, which are the resources more likely to be affected by the loss or alteration of habitats. The analysis usually addresses three factors:

- abundance and distribution of resources,
- access to resources, and
- competition for use of resources.

Under ANILCA, if it is found that a significant restriction of subsistence resources may occur because of a specific project or cumulatively for a geographic area, additional analysis and findings are required.

ANILCA initially provided for the State of Alaska to maintain subsistence management authority over both state and federal lands, as long as the Secretary of the Interior found that the state was in compliance with the provisions of ANILCA. Three basic components of ANILCA are (1) a subsistence use priority for rural Alaska residents on federal land, (2) the maintenance of customary and traditional subsistence uses of such rural Alaska residents, and (3) an important consultative role for rural Alaska residents in the formation and implementation of subsistence management. In 1990, the federal government took over the management of subsistence use of fish and wildlife resources on federal public lands. Federal subsistence management is implemented through the Federal Subsistence Board, supported by staff predominantly from the U.S. Fish and Wildlife Service (USFWS). Alaska residents living in rural areas are given priority in the taking of fish and wildlife on public lands for subsistence uses. In Southeast Alaska, residents of Juneau and Ketchikan have been determined to be non-rural by the Federal Subsistence Board. (Ketchikan currently is seeking rural designation.)

Tongass Land and Resource Management Plan (Forest Plan)

The Forest Plan FEIS provides a comprehensive analysis of the use and potential effects of subsistence resources for the entire Tongass National Forest and each rural community of Southeast Alaska. The analysis concluded that Forest-wide, under full implementation of the

Forest Plan, the only subsistence resource that may be significantly restricted in the future is subsistence use of deer (USDA FS 1997b).

The Tongass is divided into approximately 850 geographical units called value comparison units (VCUs). Each VCU consists of a major watershed, or a combination of minor watersheds. Land use designations (LUDs) are overlaid on the VCUs. It is the LUD that determines the degree of development and resource use. Many LUDs can occur in one VCU and many VCUs can occur in one LUD. Southeast Alaska is also further divided by the Alaska Department of Fish and Game (ADF&G) into "minor" units that correspond (in most cases) to forest VCUs. The ADF&G collects information about resource uses in these minor units for all species except deer. For deer, the ADF&G defines a larger geographical area, known as a wildlife analysis area (WAA). The Tuxekan project area consists of WAA 1531.

State and federal wildlife management regulations are written for larger geographical areas known as game management units (GMUs), which are comprised of multiple WAAs. The Tuxekan project area is within GMU 2. Information discussed in this section is based on information prepared or designed for these specific geographical areas.

Subsistence Resources and Uses

Residents of Southeast Alaska use subsistence products for much of their food, either as a base or a supplement. They also tend to harvest multiple types of subsistence resources. Fish and game are a widely preferred source of food, regardless of household income. Eighty-five percent of all households in rural Southeast Alaska harvest at least some subsistence resources. Sixty-one percent of all households harvested at least four different types of fish, wildlife, and/or plant resources in 1987 (Kruse and Muth 1990). Subsistence activities represent a major focus of rural life. These activities include hunting, fishing, trapping, clam digging, collecting sea bird eggs, and picking berries, plants, and edible roots. Even for households that can afford to purchase all their own food, gathering of subsistence resources is an important cultural and social aspect of family and community life.

Tuxekan Island is accessible only by sea or air. Naukati is located in the north-central part of Prince of Wales Island, on the western shore and is the hub for marine traffic to and from Tuxekan Island. Naukati is on the road system of Prince of Wales Island and is developing marine infrastructure (including floatplane infrastructure) to support community residents and residents of outlying communities. Basic commodities for community residents are obtained from subsistence activities on the Forest or are brought in from larger Prince of Wales Island communities. A total of 135 persons were living in the community at the time of the 2000 Census. During the informal telephone interviews, Naukati residents indicated that the population of their community has declined significantly over the last ten years, primarily due to the downturn in timber harvesting activities in the area. Those families reliant on wages to support their households are increasingly traveling farther away to find employment. There is little economic activity in the community.

Subsistence Use of Fish

For most communities in Southeast Alaska, the most frequently consumed subsistence resource is fish. Only rural Alaska residents of communities with customary and traditional use of specified fish stocks (none of which is located in or near the Tuxekan project area) were defined as subsistence users of these stocks. In Southeast Alaska, Craig, Klawock,

Kasaan, Hydaburg, Saxman, Sitka, Klukwan, Kake, Hoonah, Haines, Yakutat, and Angoon were found to have customary and traditional use for certain fish stocks.

Harvesting salmon and other fish is an important activity in the area and an important part of the local culture. Area communities identifying Tuxekan Island as part of their community use area for work, recreational, and subsistence activities were Coffman Cove, Craig, Edna Bay, Klawock, Naukati Bay, Point Baker, Port Protection, Thorne Bay, and Whale Pass (USDA FS 1997a). As noted in Table 3-60 below, reliance on salmon ranged from 13 percent of the total subsistence harvest in Port Protection to 35 percent in Thorne Bay. Use of non-salmon fin fish represented from 20 percent of all subsistence harvests in Whale Pass to 49 percent in Edna Bay (ADF&G 2004).

Table 3-60. Per capita subsistence use of fish[a]

Community	Per Capita Subsistence Use – All Resources (Pounds)	Per Capita Subsistence Use of Salmon (Pounds)	Percent Salmon Relative to Total Subsistence Use	Per Capita Subsistence Use of Non-Salmon Fin Fish (Pounds)	Percent Non-Salmon Fin Fish Relative to Total Subsistence Use
Coffman Cove	276	63	23%	83	30%
Craig	231	65	28%	63	27%
Edna Bay	383	55	14%	186	49%
Klawock	320	105	33%	78	24%
Naukati Bay	242	49	20%	73	30%
Point Baker	289	82	28%	89	31%
Port Protection	451	59	13%	111	25%
Thorne Bay	179	62	35%	37	21%
Whale Pass	185	28	15%	36	19%

[a] Source: Source: Alaska Department of Fish and Game Community Profile Database, 2004

Subsistence Use of Wildlife

The principal subsistence wildlife resources of the project area are deer, black bear, and small fur-bearers such as marten and wolf.

Table 3-61 summarizes data from the ADF&G Community Profile Database regarding the percentage of households using subsistence resources and per capita use of those resources. Communities indicating the highest use of black bear were Coffman Cove, Edna Bay, and Naukati. Those communities in which small mammals are harvested by a significant portion of households were Coffman Cove, Naukati, and Meyers Chuck. Black bear and small mammals, which include martin and wolf, constitute a very small portion of subsistence harvest in all communities. Deer was used by the majority of the residents of all communities.

Meyers Chuck and Hydaburg were least dependent on deer as a portion of their subsistence harvest at 5.1 percent) and 9.1 percent respectively. In all other communities, deer represented from 12.9 to 22.5 percent of the annual subsistence harvest. In two communities closest to the project area, Edna Bay and Naukati, deer represented 22.5 and 18.7 percent of the annual subsistence harvest. Communities using the most deer per capita were Edna Bay followed by Coffman Cove, Klawock, Craig, Naukati, and Petersburg (ADF&G 2004).

In 1988, the Tongass Resource Use Cooperative Survey (TRUCS), a detailed subsistence resource and use inventory of the Tongass, was begun as part of the Forest Plan revision process. The TRUCS was directed by the University of Alaska's Institute of Social and Economic Research (ISER), in conjunction with the Forest Service and the ADF&G's Division of Subsistence. In the TRUCS, researchers visited 30 communities in Southeast Alaska and conducted interviews with members of randomly selected households about their subsistence practices in 1987. All rural Southeast Alaska communities were included. Temporary communities, such as logging camps, were not included in the community profiles (for example, Naukati on Prince of Wales Island). Urban communities (Juneau and Ketchikan) were also not included, as these communities are classified as non-rural by the Federal Subsistence Board. However, Saxman, located adjacent to the Ketchikan community, is defined as rural and is listed as a separate community. Outlying communities were often incorporated into the totals of larger nearby communities or incorporated into the regional totals.

Table 3-61. Percentage of households using subsistence resources and per capita use by community [a b]

Community	Percentage of Households Using Subsistence Resources (Per Capita Use in Pounds)			
	All Resources	Deer	Black Bear	Small Mammals [b]
Coffman Cove	100% (276 lbs.)	70% (55 lbs.)	32% (4 lbs.)	16% (<1 lb.)
Craig	99% (231 lbs)	76% (47 lbs.)	8 % (<1 lb.)	6 % (<1 lb.)
Edna Bay	100% (383 lbs.)	92% (86 lbs.)	33% (3 lbs.)	0% (0 lbs.)
Hollis	96% (169 lbs.)	57% (31 lbs.)	7 % (<1 lbs.)	4% (>1 lbs.)
Hydaburg	100% 384 lbs)	69% (35 lbs)	0% (0 lbs.)	6% (>1 lb.)
Klawock	100% (320 lbs)	72% (48 lbs)	6% (<1 lbs)	5 % (>1 lbs.)
Naukati	98% (242 lbs)	68% (45 lbs)	32% (5 lbs)	12% (<1 lb.)
Meyers Chuck	10% (414 lbs)	80% (21 lbs)	10% (>1 lbs)	30% (>1 lbs)
Petersburg	97% (198 lbs)	70% (44 lbs)	5% (<1 lbs)	6% (>1 lbs)
Saxman	97% (94 lbs)	58% (17 lbs)	8% (>1 lbs)	0% (0 lbs)
Thorne Bay	93% (179 lbs)	54% (32 lbs)	6% (1 lbs)	6% (>1 lbs)
Wrangell	95% (155 lbs)	63% (20 lbs)	8% (1 lbs)	2% (>1 lbs)

[a] Source: Source: Alaska Department of Fish and Game Community Profile Database, 2004.
[b] Figures for Small Mammals include martin and wolf.

As part of the TRUCS interviews reported in Appendix H of the Forest Plan FEIS, community residents were asked to indicate on a map those areas that they used for deer

hunting. Nine communities indicated that WAA 1531 was part of their traditional use area. These communities were Coffman Cove, Craig, Edna Bay, Hollis, Hydaburg, Klawock, Saxman, Thorne Bay, and Wrangell. Edna Bay residents estimated that five to ten percent of the community's deer harvest was obtained in WAA 1531. All other communities estimated harvest from WAA 1531 at one to five percent. Meyers Chuck residents indicated that WAA 1531 was one of six WAAs where 75 percent of the community's deer harvest was obtained from 1989 to 1995. Naukati residents indicated that WAA 1531 was one of two areas where 75 percent of the community's deer harvest was obtained during the same period (USDA FS 1997a).

Changes in these patterns of use have occurred since the TRUCS was conducted. Subsistence land use patterns are dynamic. As human populations and their demographics change, resource abundance and distribution also change. As noted in informal interviews with residents of northern Prince of Wales Island, the opportunity for employment in or around an area was the primary factor in determining hunting and fishing grounds not directly adjacent to their resident communities. As an example, the community of Naukati was an active logging community from the mid-1970s to the mid-1990s. Prince of Wales Island residents working in that area would hunt and fish after work. Now that the area's community (and employment opportunities) has significantly declined, many interviewed residents said they no longer have reason to travel into that specific area and have foregone resource gathering activities there.

Harvest survey data for 1996 through 2003 from the ADF&G is displayed in Table 3-62. The ADF&G sends surveys to approximately one third of hunters each year. Overall, response rates varied from a low of about 56 percent up to 63 percent. Because response rates vary by community, an expansion factor is used in order to obtain an estimate for all hunters possessing deer harvest tickets; the lower the expansion factor, the greater the probable accuracy of the estimate. All of the communities below had expansion factors that were fairly close to the average for the state of about 5.0 to 5.5. The communities with slightly higher expansion factors on average were Craig, Edna Bay and Hydaburg.

Total estimated harvest in WAA 1531 over an eight-year period was only 125 animals. No harvests were reported in 1997 and 1999. The largest harvests occurred in 1998, 2000, and 2001 with 20, 38, and 29 animals respectively. All other years had reported harvests of 10 or fewer animals. The communities taking the largest share of animals from WAA 1531 are Wrangell, Naukati, Ketchikan, and Craig. Based on this harvest data, none of the communities represented obtained a significant portion of the community's deer harvest from WAA 1531. Naukati residents appear to obtain the largest portion of their deer harvest from Tuxekan Island, even then the animals taken represented and average of only 3.3 percent of the community's total harvest over an eight-year period.

Table 3-62. Harvest by community in Wildlife Analysis Area (WAA) 1531, 1996 through 2003[a]

Community	Number of Years Hunting Effort Was Reported (Out of the 8 Years Surveyed)	Percentage of WAA 1531 Harvest	Percentage of Each Community's Deer Harvest Reported from WAA 1531
Craig	2	14.0%	0.4%
Edna Bay	0	0.0%	0.0%
Hollis	1	2.0%	0.8%
Ketchikan	3	16.0%	0.2%
Klawock	1	6.0%	0.3%
Meyers Chuck	1	0.0%	0.0%
Naukati Bay	3	20.0%	3.3%
Petersburg	2	7.0%	0.2%
Thorne Bay	1	0.0%	0.0%
Wrangell	3	36.0%	0.4%
Total	**8**	**100.0%**	**0.4%**

[a] Source: Alaska Department of Fish and Game, 1996. 1997, 1998, 1999, 2000, 2001, 2002, 2003, and 2004.

General land use patterns for deer hunters can be explained by a few basic principles or factors:

- Hunters generally prefer to hunt near their place of residence.
- Hunting often occurs near a place of employment, even at a considerable distance from home.
- Relatives and friends often travel considerable distances to hunt with local residents or workers.
- Management regulations (bag limits, length of season) can greatly affect the areas hunted.
- Road access greatly affects and, in some cases, determines where an individual can hunt deer.
- Motivation for hunting (recreation, efficient harvest of meat) affects the hunting areas that people choose.
- The length of the hunting season affects the use of an area for hunting.

Approximately one-half of rural Southeast Alaska households reported the presence of clearcuts of various ages in currently reliable deer harvest areas (44 percent) and in the most-often-used deer harvest areas (48 percent) (Kruse and Muth 1990). Many residents in the area of Tuxekan Island/north Prince of Wales Island credit the logging of northern Prince of Wales Island with creating a great increase in deer forage. The network of logging roads has helped to make the hunting terrain more accessible to hunters. Before the road systems were developed, access to deer was primarily by boat and by foot. Public comments indicate the desire for maintenance of existing roads and for building more roads to the extent that they are justified by the economics of the timber sale. This was especially apparent during contacts with the older residents of north Prince of Wales Island and Kosciusko Island, who hunted regularly in their youth but are now concerned about the hiking distance to the hunting areas. Residents also mentioned a change in their hunting and harvesting areas with

respect to economic opportunities. As a result of the decrease in timber-related work on the west coast (Naukati area) of Prince of Wales Island, area residents indicated they are hunting in other areas of the island closer to existing employment opportunities. Because Naukati is a hub for transit to Tuxekan Island, this sentiment is expected to indirectly affect hunting on Tuxekan Island as well.

Residents of Wrangell have harvested the largest portion of deer from WAA 1531 over the last eight years. However, the community's lower per capita use of subsistence resources, particularly deer, indicate that changes in subsistence resources in WAA 1531 may not have a significant effect on Wrangell residents. Naukati residents' higher reliance on deer for subsistence uses, close proximity to the project area, and past use of WAA 1531, indicate that this community may be most likely to be impacted by changes in the availability of subsistence resources in WAA 1531. Although recent harvest surveys do not show use by residents of Edna Bay, the community's higher level of dependence on deer for subsistence purposes and close proximity to WAA 1531 suggest an increased potential for impacts to this community also.

Subsistence Direct / Indirect Effects

Subsistence Direct / Indirect Effects Common to all Alternatives

Salmon and Trout Species

With the application of the riparian standards and guidelines of the Forest Plan, no significant adverse or cumulative effects on salmon or trout species are expected under any alternative (see the "Fisheries Resources" section). Subsistence use of fish species is not expected to increase in the project area.

Bears and Small Mammals

No significant adverse direct, indirect, or cumulative effects to bear are expected under any alternative (see the "Wildlife"section). Additionally, no significant long-term effects are anticipated on small mammals such as marten and wolves (see the "Wildlife"section). Although open road densities would increase in the short-term during timber sale implementation, the access management plan would result in road closures following completion of harvest activities. Open road densities would be reduced from the existing condition of 1.4 miles per square mile to 0.8 mile per square mile under all action alternatives. This combined with the existing limits on access to Tuxekan Island (transportation by boat or air only with no scheduled commercial access) would contribute to reduced hunting pressure in the long-term. Hunting and trapping seasons for these species occur during the normal winter shutdown period for timber sale activities. Therefore, there is little potential for increases in hunting pressure as a result of increased human presence during the implementation of timber sale activities. Furthermore, in the case of wolves, federal regulations currently provide that the Federal hunting and trapping season may be closed when the Federal-State harvest quota is reached (U.S. Fish and Wildlife 2004).

Deer

Abundance and Distribution

Declines in deer habitat capability (i.e., the number of deer available to humans) are measurable. Deer habitat capability in the project area after adjustment for predation has decreased by approximately 40 percent on Tuxekan Island due to timber harvesting between 1954 and 2005. Under all alternatives, including the no action, deer habitat capability would continue to decrease as existing second-growth stands enter the stem exclusion stage. This decline represents a cumulative trend that would continue to occur with additional harvesting of old-growth timber (see the discussion of deer habitat and subsistence use above under Issue 3 – Wildlife).

The distribution of deer would change in response to changes in habitat capability. Once second-growth stands reach the stem exclusion stage, these stands would not support the number of deer that were supported prior to harvesting. As deer become harder to find, competition between rural and non-rural hunters could increase.

For the Sitka black-tailed deer the most limiting factor in the project area is high-value deer winter habitat. The declines to this habitat as a result of the proposed project would be minimized in several ways. The Forest Plan requires the application of riparian buffers along all streams, and the location of a small OGR in each VCU. This provides some protection of high-value deer winter habitat.

While the direct effects of the alternatives do not present a significant possibility of restriction on subsistence uses of deer, deer abundance may decrease after existing harvest units enter stem exclusion and habitat capability drops. However according to model predictions, the resulting deer densities with full implementation of the Forest Plan would remain above the recommended number of 18 deer per square mile, even at the onset of stem exclusion in 2054.

Competition

Competition for resources generally occurs where limited resources are accessible to a large number of people. Under ANILCA, a priority for use would be granted to rural users if restrictions on use of a resource are necessary. If further restrictions are necessary, significant limitations on subsistence uses may occur. Such restrictions could occur as a result of reduced abundance or increased competition. Refer to the Forest Plan FEIS pages 3-222 and 3-223 for an in-depth discussion.

A deer population at carrying capacity should be able to support a hunter harvest (demand) of about 10 percent of the winter habitat capability to be sustainable and provide a reasonably high level of hunter success. Hunter success can be expected to decline in areas where demand is greater than 10 percent of winter habitat capability. Yet, with no reliable estimates of the deer population, it is difficult to determine if this is being exceeded.

The Forest Plan FEIS (Appendix H-81) predicted that by 2005 total hunter demand in WAA 1531 would be approximately 40 animals. An examination of deer harvest data collected by the ADF&G from 1996 through 2003 confirms this projection. Estimated harvests from WAA 1531 have ranged from 0 to 39 animals annually, with an average of 16 per year, which falls well within Forest Plan projections. By the end of the stand rotation in 2095, total annual hunter demand for deer harvest was projected to be approximately 72 animals in

WAA 1531. Within that, the estimated demand by subsistence hunters was projected to be 66 animals. The Forest Plan FEIS (page 3-611) projected that habitat capability would be sufficient to meet the expected demand for deer by all hunters.

In Game Management Unit 2 (GMU 2), which consists of Prince of Wales Island and most outer islands to the west, hunter success was reported as stable for a ten year period but decreased in 1997 (ADF&G 1997). In 1998, deer hunting success in GMU 2 rebounded from an apparent low in 1997. Hunter success in GMU 2 since 1997 appears to have remained relatively stable with estimated days afield per deer harvested ranging from 4.2 to 5.2 from 1998 through 2003 and the estimated rate of successful hunters ranges from a low of 58 percent in 2002 to a high of 66 percent in 2001.

Responses from two of the communities closest to WAA 1531, Edna Bay, and Naukati Bay had an unusually low number of responses during 1999. During that year, no harvest was reported from 1531, suggesting the possibility that hunting activity may have occurred in WAA 1531 but gone unreported. Estimated success rates in WAA 1531 have been somewhat variable from year to year from 1998 to 2003. The number of hunters estimated may indicate a declining trend with a high of 37 hunters in 2000 down to approximately 21 hunters in 2003. The estimated percentage of successful hunters has ranged from 80 percent in 2001 to a low of 43 percent in 2003. The estimated days afield per deer harvested has fluctuated each year with a high of 6.4 days per deer in 2002 to a low of 1.2 days in 2003.

Access

Roads can affect subsistence by providing access, which can serve to disperse hunting and fishing pressure. Roads can also concentrate use resulting in increased competition. No restrictions on access to the project area for subsistence uses are anticipated during the course of harvest operations. However, following completion of harvest operations, implementation of an access management plan following harvest activities would impact access for subsistence uses. These actions are discussed by alternative below.

Subsistence Direct / Indirect Effects Specific to Alternative 1

Deer

Abundance and Distribution

Under Alternative 1, current and on-going management activities would continue. However, no new Forest Service vegetation management activities would be initiated as a result of this project. Changes to the environment might occur through current management direction, such as road maintenance, natural processes, or other future management decisions.

Use of the interagency deer model results in an estimate of current deer habitat capability of 1,437 deer or 26 deer per square mile on National Forest System lands in WAA 1531 after accounting for predation by wolves.

Competition

Alternative 1 (No Action) would not result in any changes in competition in the project area.

Access

Alternative 1 (No Action) would not result in any changes in road management in the project area.

Subsistence Direct / Indirect Effects Common to Alternative 2, 3, 4 and 5

Deer

Abundance and Distribution

With the application of the riparian standards and guidelines of the Forest Plan, no significant adverse or cumulative effects on salmon or trout species are expected under any alternative (see the "Fisheries Resources" section). Subsistence use of fish species is not expected to increase in the project area.

The deer model was developed for the Forest Plan and was designed to measure impacts to the entire Tongass National Forest (17 million acres). The model is not sensitive to the small differences in the acres of harvest proposed for each alternative (proposed harvest range is only 193 acres among the alternatives) and does not show significant differences between the alternatives. Alternatives 2, 3, 4, and 5 show little change in the deer habitat capability from the existing condition. The model estimates of habitat capability for WAA 1531 are displayed in Table 3-55 Deer model results for WAA 1531 in the discussion of Issue 3 above. The model projects habitat capability of approximately 26 deer per square mile under Alternatives 2 and 4 and 25 deer per square mile under Alternatives 3 and 5 after reductions for predation. These estimates do not take into account additional habitat capability provided by non-National Forest System lands.

For analysis of impacts to deer between alternatives, a comparison of acres of proposed harvest in high-value deer habitat was conducted. The Tuxekan analysis area contains approximately 8,717 acres of high value deer habitat, as classified by the deer model. Alternative 3 proposes the most acres of harvest in high-value deer habitat, 540 acres. Alternative 4 proposes the least, 357 acres, and Alternatives 2 and 5 fall between 3 and 4 with 415 and 493 acres respectively of harvest in high-value deer habitat. The direct and indirect impacts of these changes alone would not be expected to represent a significant restriction of subsistence use based on abundance and distribution.

Offsetting the impacts resulting from the reduction of deer wintering habitat, the harvest units from all alternatives would provide new forage after harvest. This new forage would mitigate declining forage production in the existing second-growth stands that are in or are entering the stem exclusion stage. In addition, the proposed harvest units are intentionally more dispersed and relatively smaller in average size (16 to 18 acres) compared to previous harvest units on Tuxekan Island. The existing second-growth units are larger and are situated in groups on the island. The replacement of forage and the dispersal of smaller harvest units would help reduce the impacts to deer over the short-term.

Competition

During the time when the proposed timber sale would be implemented (approximately five years), it is likely that the workers who come to Tuxekan Island would harvest deer. Therefore, short-term competition with the Naukati and Edna Bay residents for subsistence

deer is probable. Workers may be from other subsistence communities, in which case their competition would constitute an increase in subsistence demand. Hunters not from subsistence communities would represent increased competition that may reduce the supply of deer available to subsistence users, which may result in a restriction of subsistence use. Such increases in demand are not expected to be significant.

Access

The access management plan and the road management objectives (Appendix C) for the Tuxekan Project recognize the importance of road access for subsistence users of the project area. However, access to subsistence resources is only one aspect of managing the Tongass. Roads and associated structures that may be necessary for access to subsistence resources can have potentially severe impacts on surrounding natural resources and systems. These impacts can in turn affect the habitat necessary to sustain many subsistence resources.

Many factors influence decisions to alter the existing, or modify the proposed road access in a given area. A few of these factors are: available funding for maintenance, safety considerations, application of Forest Plan Standards and Guidelines, subsistence and recreation activities, access for management activities, ongoing road maintenance, and other public concerns. The responsible official must also balance these factors with conflicting public opinions regarding whether a particular road should be closed or remain open. The final decision regarding road access for the Tuxekan Project is dependent on available funding, future management needs, public comments on the Draft Environmental Impact Statement (DEIS), and any concluding changes documented in the Record of Decision (ROD). Please refer to the Transportation section for a more detailed discussion of roads management.

The access management plan, which would be implemented under each of the proposed action alternatives, proposes to close approximately 14.6 miles of the 36.6 miles of open and drivable existing roads within the analysis area. The remaining 22 miles of existing NFS roads would be open to high-clearance vehicles or off-highway vehicles to provide access to subsistence resources (see Road Management for a detailed discussion of the treatment of existing roads). Many of the road closures would be at the end of open roads (those that are open to all types of vehicle travel), and other closures would occur beyond the end of storm-proofed roads in the project area. Because of the locations of these road closures, it would be possible for subsistence users to access a large percentage of the road by vehicle and the remaining section of the closed road by foot.

Although the miles of proposed roads vary under each action alternative, the percentage of closed roads is the same. All NFS and temporary roads proposed for the Tuxekan Project would be placed into storage or decommissioned after completion of harvest activities. The miles of stored or decommissioned roads varies under each action alternative (Alternative 2 proposes 6.2 miles of new roads, Alternative 3 proposes 9.6 miles, Alternative 4 proposes 6.0 miles, and Alternative 5 proposes 8.8 miles).

The proposed timber sale itself would not change access, other than temporarily improving it by adding short segments of NFS and temporary road and improving the maintenance of other roads for the timber harvest operations. The new roads would be closed at the end of the sale. However, in conjunction with any of the action alternatives, an access management plan would be implemented that would effectively close a number of secondary roads and a

few main roads. The access management plan implements current national and Forest-wide direction for road management.

The access management plan would decommission selected roads and would place in storage many of the secondary roads in the project area on National Forest System lands. Most of the secondary roads that would be affected have become overgrown with alders and are not drivable. Most of the main road system in the project area would remain open. The roads that are decommissioned or placed in storage would be accessible to people on foot, which is reasonable to provide a mix of hunting opportunities in the project area. Therefore, although access might be restricted somewhat, it would probably have little effect on subsistence hunting. Nevertheless, this potential restriction is disclosed.

Subsistence Cumulative Effects

The analysis area for direct, indirect, and cumulative effects is Wildlife Analysis Area 1531 as this area encompasses the proposed project area. The time frame considered is until the end of stand rotation, approximately 2095, in order to evaluate the effects of the alternatives in concert with full Forest Plan implementation.

Subsistence Cumulative Effects Common to all Alternatives

Deer

Deer harvest data specific to the proposed project area is not available; therefore the analysis area for cumulative effects is WAA 1531. The timeframe considered is until the onset of stem exclusion, approximately 2054.

This analysis primarily assesses the additive effects of timber harvesting and associated or similar activities. The preceding discussion of Issue 3 - Wildlife in this chapter provides a listing of existing, accomplished, and planned timber management activities in WAA 1531.

Abundance and Distribution

Previous timber harvesting and the resulting loss of habitat capability on the Tuxekan project area have been extensive. Additional timber harvesting in the project area would further decrease deer habitat capability. Cumulative past harvest has resulted in the considerable likelihood for impacts to subsistence deer hunting. Any future harvesting, combined with this project, would increase the likelihood of potential impacts.

Competition

The Forest Plan FEIS (Appendix H-81 page 3-611) predicted that by the end of the stand rotation in 2095, total hunter demand for deer harvest would be less than 10 percent of the winter habitat capability in WAA 1531 and that all projected hunter demand would be met.

A new Alaska State Ferry Terminal is scheduled to be constructed in the community of Coffman Cove with service anticipated to begin in the spring of 2006 (Inter-Island Ferry Authority 2005). With the new ferry sailing, a 2 percent increase in visitors to Prince of Wales Island is anticipated (Miller 1996). Whether increased hunting access on Prince of Wales Island translates directly or indirectly into hunting activity in the Tuxekan Project Area remains to be seen. However, the increased visitation to Prince of Wales Island has the

potential to contribute to increased public notice and use of Tuxekan Island by hunters from outside the immediate area, thereby increasing competition for subsistence resources.

Subsistence Cumulative Effects specific to Alternative 1 – No Action

Deer

Abundance and Distribution, Competition, Access to Resources

No additional effects are expected from implementation of Alternative 1 beyond those described above in effects common to all alternatives.

Subsistence Findings

The potential foreseeable and cumulative effects in the cumulative effects area from implementing the Forest Plan through the entire rotation period, including the No Action Alternative, do not present a significant possibility of a significant restriction to subsistence uses of black bear, furbearers, marine mammals, waterfowl, salmon, other finfish, shellfish, timber resources, and other foods such as berries and roots. However, a significant possibility of a significant restriction may exist for deer.

Subsistence Cumulative Effects Common to Alternatives 2, 3, 4 and 5

Deer

Abundance and Distribution

By the year 2054, assuming full implementation of the Forest Plan, deer habitat capability would be approximately 23 deer per square miles in WAA 1531 for all the action alternatives. The cumulative effects of past timber harvest and future timber harvest, including the proposed project together with the potential to experience a deep snow winter may represent a significant possibility of a significant restriction of subsistence use.

Competition

Estimated existing and projected habitat capability is sufficient to meet current demand. The Forest Plan FEIS (page H-81) projected that rural hunter demand would be 66 animals annually by 2095. Total hunter demand was projected to be 72 animals. These projections fall within ten percent of the total winter habitat capability, even after adjustment for predation.

The Inter-Island Ferry Authority began twice-daily service seven days a week from Ketchikan to Hollis (on Prince of Wales Island) in 2002. This replaced the sporadic seasonal service (two to three scheduled weekly trips) historically provided by the Alaska Marine Highway Service between Ketchikan and Prince of Wales Island during the fall (September through December). With increased marine transportation service, Ketchikan (and Saxman) residents have easier access to Prince of Wales Island (Miller 1996). With easier accessibility to areas near WAA 1531 (on Tuxekan Island), increased hunting activity would become more probable in the project area, although ADF&G harvest data for 2003 do not reflect an increase harvest levels in WAA 1531. Similarly, the new Alaska Ferry Terminal in Coffman

Cove will facilitate travel between Prince of Wales Island and the communities of Wrangell and Petersburg. It is generally agreed that increased travel by residents for hunting and fishing opportunities would occur. It is unknown whether increased hunting access on Prince of Wales Island would translate directly or indirectly into hunting activity in the Tuxekan project area. However, over the last eight years, estimates derived from ADF&G harvest surveys indicate that Wrangell residents have harvested the largest portion of deer taken from WAA 1531 (36 percent) (ADF&G 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004). Improved access for Wrangell residents may translate into increase deer harvests in WAA 1531.

Access

Project related activities would not restrict access to deer. New NFS and temporary roads would be constructed (6.2 miles under Alternative 2, 9.6 miles under Alternative 3, 6.0 miles under Alternative 4, and 8.8 miles under Alternative 5). However, new NFS roads would be placed in storage, temporary roads would be decommissioned following completion of harvest activities, and all motorized use on these segments would be eliminated. Therefore, any improvement to motorized access would be of short duration (3-5 years). Additional roads would not increase the number of hunters, but would extend access from existing roads into new areas.

Road management associated with future small salvage sales along existing roads, and future commercial thinning of stands harvested in the 1940s would not materially affect access.

Subsistence Findings

Following an analysis of the individual effects of the ANILCA categories, there is little likelihood that subsistence use in the Tuxekan project area would be substantially affected by any of the action alternatives. However, as previously disclosed, the cumulative effects of past and future timber harvests (and associated activities), along with those of the proposed project, together with the potential to experience a deep snow winter may represent a significant possibility of a significant restriction of subsistence use of deer.

With regard to other subsistence resources, the potential foreseeable effects from the action alternatives in the Tuxekan project area do not indicate a significant possibility of a significant restriction of subsistence uses for black bear, furbearers, marine mammals, waterfowl, salmon, other finfish, shellfish, timber resources, and other foods such as berries and roots.

ANILCA Compliance

ANILCA Section 810 (a)(3) requires that when a significant restriction may occur, determinations must be made with regard to the following:

- Whether such a significant restriction of subsistence uses is necessary and consistent with sound management principles for the use of public lands;
- Whether the proposed activity will involve the minimum amount of activity on public lands necessary to accomplish the purpose of such use and occupancy, or other disposition; and

- Whether appropriate steps will be taken to minimize adverse impacts on subsistence uses and resources resulting from such actions.

Necessary, Consistent with Sound Management of Public Land

ANILCA places an emphasis on the maintenance of subsistence resources and lifestyles. However, it also emphasizes providing adequate opportunity for the satisfaction of the economic and social needs of the State of Alaska and its people, and it recognizes public lands that are necessary and appropriate for more intensive uses. ANILCA also requires the Forest Service to make available from the Tongass National Forest a specific quantity of timber for harvest per decade. The Tongass Timber Reform Act (TTRA) removes the specific amount of harvested timber requirement and instead directs the Forest Service to seek to meet market demand for timber to the extent consistent with providing for the multiple use and sustained yield of all renewable Forest resources, subject to applicable law.

The proposed action alternatives are necessary as a component of the timber management program designed to implement the Forest Plan and comply with TTRA direction. The proposed alternatives provide various options that can help meet the objectives of the Forest Plan and the TTRA for timber harvests, while also providing reasonable protection measures for forest resources, especially for subsistence. The alternatives are consistent with the Forest Plan, laws, regulations, policies, public needs, and capabilities of the land.

Amount of Land Necessary to Accomplish the Purpose of the Activity

The amount of public land necessary to implement each alternative is, (considering sound multiple use management of public lands), the minimum necessary to accomplish the purpose of that alternative. Rural communities use the forested portion of the Tuxekan project area for subsistence deer hunting as a minimum. It is not possible to reduce harvest in one area and concentrate it in another without affecting the important subsistence use areas in one or more rural communities. In addition, harvestable populations of game species may not be maintained in a natural distribution across the Forest if harvest is concentrated in specific areas. A well-distributed population of species is required by the Forest Service regulations, which implement the National Forest Management Act (NFMA). (See the Wildlife section for more on mitigation measures to ensure well-distributed species population.)

Forest Plan (Forest Plan). The Forest Plan allocated many of the important subsistence use areas to LUDs that are not suitable for timber harvest. Of the 16,896 acres of the project area on National Forest System lands, the Forest Plan allocated 86 percent (14,461 acres) to the timber production LUD. LUD designations provide for resource use and development for commodity resources such as timber. The Forest Plan Standards and Guidelines removed additional acres, important for subsistence, from the suitable timber base, including 1,000-foot buffers around the beach and all estuaries, OGRs, and specific riparian buffers along all Class I, II, and III streams to protect fish habitat and water quality.

Each alternative provides a sound location and design for all harvest units and roads. Given the framework and emphasis of a given alternative, the amount of land and roads was kept to a minimum to resolve resource concerns while meeting the purpose and need for the project in a practical and efficient manner. The Tuxekan Project involves the minimum amount of public land necessary and provides a balance between meeting the needs of the public and protecting forest resources.

Reasonable Steps to Minimize Adverse Impacts on Subsistence Uses and Resources

The Forest Plan took considerable steps to minimize the impacts to subsistence use and resources. Traditional use areas include the beach fringe and stream buffers protected in the Forest Plan. Alternative 2 would adjust the boundaries of the small OGRs in the project area in accordance with the interagency committee recommendations with small adjustments to accommodate harvest. Alternative 3 would adjust the boundaries of the small OGRs in limited ways to include more old-growth stands and high-value deer winter range. Alternatives 4 and 5 would fully implement the interagency committee’s recommended boundary changes to all four small OGRs in the project area, providing the highest level of protection for old-growth forests identified as providing high-quality wildlife habitat. Changes to the old-growth reserves are summarized in Table 3-63 below and are discussed in more detail under Issue 3, Wildlife. These changes would strengthen the old-growth reserve strategy and help minimize adverse impacts to subsistence uses. The overall Forest Plan land use designation strategy, silvicultural prescriptions, road access management strategy, and other measures, represent reasonable steps to minimize adverse impacts to subsistence resources.

Table 3-63. Proposed small OGRs acreages in the Tuxekan Project area by alternative

VCU	Forest Plan Requirements	Alt. 1 (Existing)	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Total OGR acres						
556	913	588	1,115	1,091	1,124	1,124
557	1,135	587	1,128	1,144	1,133	1,133
560	941	627	1,133	1,021	1,153	1,153
587.2	515	656	537	656	531	531
POG acres						
556	456	531	932	803	941	941
557	567	518	806	798	811	811
560	470	429	834	734	854	854
587.2	400	420	511	420	498	498

Each alternative framework represents a reasonable balance between projected need for Tongass timber from the project area to help meet Forest Plan, ANILCA, and TTRA timber-related objectives, and continued protection of subsistence uses and resources.

Many of the mitigation measures for the Tuxekan Project, identified on the unit and road cards (Appendices B and C), are designed to maintain fish and wildlife habitat productivity at the highest possible level, while still providing a supply of timber.

Subsistence hearings for the Tuxekan project were held in Naukati on August 22, 2005 and in Craig on August 23, 2005 to give residents an opportunity to express their concerns and suggestions relative to subsistence impacts. No publics attended these meetings, and no comments were received.

Consistency with Forest Plan

The desired condition of providing rural residents opportunities to participate in subsistence activities and harvest subsistence resources would be maintained under all alternatives. Consideration of the effects of the alternatives and efforts to minimize cumulative impacts to subsistence resources are reflected in the design of the action alternatives. All new NFS and temporary roads under the action alternatives would be closed upon completion of sale activities precluding the use of motorized vehicles once timber harvest activities are completed. Any increase in access leading to an increase in competition would be limited to foot traffic during the hunting season.

Alternative 1 is not consistent with direction relative to Forest Plan old-growth reserve criteria (USDA FS 2002; USDA FS 1997a - Forest Plan App. K). Currently-designated small OGRs as currently mapped, are smaller than required by Forest Plan direction in three of the four VCUs. Additionally, two VCUs do not meet direction requiring that a minimum of fifty percent of the area within small OGRs be productive old-growth.

All of the action alternatives would be consistent with Forest Plan direction. Alternative 2 would adjust the boundaries of the small OGRs as mapped in the Forest Plan in the project area in accordance with the interagency committee recommendations with small adjustments to accommodate harvest. Alternative 3 would adjust the boundaries of the small OGRs in limited ways to include more old-growth stands and high-value deer winter range. Alternatives 4 and 5 would fully implement the interagency committee's recommended boundary changes to all four small OGRs in the project area, providing the highest level of protection for old-growth forests identified as providing high-quality wildlife habitat. Changes to the old-growth reserves are summarized in Table 3-63 above. See the preceding section titled Direct and Indirect Effects to Old-growth Reserves for additional discussion on the small OGR boundary changes per alternative.

Other Resources

Physical Environment

Transportation Management

Introduction

Timber harvest operations in Southeast Alaska are frequently subject to public comments regarding the extent, location, duration of use, and access to existing and proposed road systems. Decisions concerning road management can affect recreational users, future timber harvests, access to subsistence resources, and the stability of species and ecosystems within an area. The design, construction, management, and mitigation measures for the road system (both current and proposed) within the Tuxekan project area conform to Forest Plan transportation standards and guidelines for the Tongass. The following discussion and analysis is based, in part, on the Tuxekan Island Roads Report (URS 2002j).

This section includes two main components that have been combined to address the overall analysis of road management within the Tuxekan project area. The first component addresses

transportation management. Transportation management pertains to the extent of proposed roads for the Tuxekan Project in addition to the costs and management of these proposed roads.

The second component of this section relates to how the existing and proposed roads would be managed upon completion of timber harvests, and in particular, if they are to remain open or closed to public use. This is referred to as access management. Access management considerations include resource protection, future access needs for vegetative treatment, the cost of road maintenance, proximity to recreation areas, and subsistence use within the area.

Transportation Management Affected Environment

The area considered for the analysis of direct, indirect, and cumulative effects for the transportation system associated with the project will be the project area boundary. The transportation analysis area is located in Value Comparison Units (VCUs) 556, 557, 560, and 587.2. The majority of the project area is located in the Timber Production LUD, with the remainder of the project in the Old-growth Habitat LUD.

Beyond this project, the POW ATM plan, and the on-going thinning project, no additional harvesting or other projects are planned for this analysis area during this planning cycle. Any future projects would require a site-specific access management plan as part of the NEPA document. The same spatial area used to analyze direct/indirect effects is used to analyze cumulative effects, and the time period considered is the transportation system in its present state through the implementation of this project (2012). These temporal and spatial boundaries are considered, because the current transportation system is the result of past activity within the project area, and includes all transportation systems needed for use by this project.

On the Tongass, the demand for roads has been primarily related to the demand for access to timber resources. The maintenance and reconstruction requirements of the existing road system depend mainly on the volume of timber hauled and, to a lesser extent, on recreational use. The amount of future road construction is anticipated to depend largely on the need to access timber resources.

The Tuxekan Island Roads Report (URS 2002d), Appendix F, and the Tuxekan Access Management plan (Table 3-67) contain most of the elements of a roads analysis. An Access and Travel Management plan (ATM) is currently being conducted for Prince of Wales Island that will include the Tuxekan Island project area. The Tuxekan Access Management has been modified to include all of the road management recommendations made in the POW ATM on NFS roads. The POW ATM made recommendations only for existing National Forest System (NFS) roads. Therefore, all new roads proposed, existing NFS roads, and 1.5 miles of unauthorized road within the project area will follow the travel management recommendations identified by the Tuxekan Access Management Plan. For further information regarding the Tuxekan Access Management Plan, see Appendix F of the Tuxekan Island Timber Sale FEIS.

Existing Condition

Tuxekan Island has an extensive road system in place resulting from past harvesting activities in the area. The timber harvesting that occurred on Tuxekan Island prior to 1960 was done from the water and did not require road construction. The majority of the current

transportation system was constructed from the 1960s through the 1980s when most of the harvesting on the island took place. There are currently 58.8 miles (including existing unauthorized roads) of existing roads on NFS lands. Of these existing roads, approximately 62 percent (36.6 miles) are open either to off-highway or high-clearance vehicles. The remaining 22.2 miles of roads are for the most part impassable to regular vehicle traffic due to the removal (or deterioration) of drainage and crossing structures and/or natural re-growth (primarily alder) across the roadway. The non-NFS land (state and private land) on Tuxekan Island is approximately 1.3 square miles (836 acres) in size and includes 1.7 miles of existing roads. Of these existing road miles within non-NFS land, approximately 88 percent (1.5 miles) are recognized as drivable roads.

Motorized access to Tuxekan is by boat from Prince of Wales Island, Alaska, or by small plane originating in Ketchikan, Alaska, or elsewhere. A seaplane base and an old Forest Service dock are available on the eastern shore of Tuxekan at Nichin Cove. The island does not receive Alaska Marine Highway ferry service. Off-highway vehicles are small enough to be transported to the island by private boats. Larger vehicles must be barged to the island.

Road Density

Road density is defined as the number of miles of open roads within a square mile and is one measure of environmental impacts. Road density and risk of impact are correlated, the higher the road density, the greater the risk of impact. These risks can be minimized and mitigated by Forest Plan Standards and Guidelines, which provide direction on road location, design, construction, and operation. Current total road density (disregarding drivable and non-drivable road characteristics) on NFS land is 2.2 miles per square mile. The current open road density on NFS land is 1.4 miles per square mile.

Road Maintenance Levels

National Forest road classifications are based on current or anticipated use and divided into five maintenance levels. Two of the maintenance levels apply to the roads on Tuxekan Island. Maintenance levels incorporate traffic service levels, as indicated in the following definitions.

- **Maintenance Level 1 (Traffic Service Level D):** Level 1 is assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed one year. Roads are closed by bridge removal, a barrier ditch, or organic encroachment and are monitored for resource protection. Basic custodial maintenance is performed to perpetuate the road and to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are to “prohibit” and “eliminate” motor vehicle traffic. These roads may be open and suitable for nonmotorized uses.
- **Maintenance Level 2 (Traffic Service Level C):** Roads are maintained for high-clearance vehicles and monitored for resource protection. Traffic is normally minor, usually consisting of administrative, permitted, dispersed recreation, or other specialized uses (alone or in combination). Log hauling may occur at this level. Appropriate traffic management strategies are (1) “prohibit” or “eliminate” passenger cars or (2) “accept” or “discourage” high-clearance vehicles.

Roads that are assigned a maintenance level are referred to as National Forest System roads. National Forest System roads are roads completely or partially within or adjacent to NFS lands that are determined to be needed for long-term motor vehicle access. These include State roads, county roads, privately owned roads, and other roads authorized by the Forest Service (36 CFR 212.1). Of the 41 miles of existing NFS roads located on National Forest land, 4.4 miles are currently assigned Maintenance Level 1, and 36.6 miles are assigned Maintenance Level 2. Maintenance Level 2 is the highest level proposed for roads on Tuxekan Island.

Road Condition Surveys

Forest Service personnel have conducted road condition surveys on many of the existing roads in the Tuxekan project area (USDA FS 1999). Updates have been made to the 1999 survey, and the recommendations have been incorporated into the FEIS. These surveys supply detailed information about each road surveyed, including:

- Whether the road, or a particular section of the road, is drivable;
- Number, size, and condition of drainage structures and bridges;
- Barriers to vehicle access (vegetation, barrier ditches, pulled bridges, slides, etc.); and
- Maintenance requirements.

This information is used to (1) identify maintenance trends, (2) provide information for problem analysis, and (3) set priorities for scheduling and funding work. During the implementation of the access management plan, the road condition surveys will be reviewed to determine site-specific problems that need to be addressed to benefit the overall condition of the area. For example, during the implementation of the access management plan, the treatment of specific roads may determine the management of individual culverts or stream crossings. The road condition surveys for Tuxekan Island may be found at the Thorne Bay Ranger District, Thorne Bay, Alaska.

Marine Access Facility (MAF)

The transportation of harvested timber on the project area will involve transporting the logs to the water (or barges) at a MAF and towing them to a sort yard for sorting. Finally, the logs would be moved to different processing sites in Southeast Alaska.

The Tuxekan Project plans to use an existing MAF at Nichin Cove located at the eastern shore of the island. Associated with the MAF is a log sort yard of a few acres. The MAF at Nichin Cove has both a bulkhead and drive-down rock ramp suitable for loading barges. The Thorne Bay Ranger District is planning to perform maintenance to the MAF site under the current permit that will improve barge-loading activities. This work could coincide with timber sale activities, but is not expected to significantly disrupt the use of the facility.

This facility is permitted through ACOE and ADEC and is within permit limits for bark accumulation. The last dive survey performed at the MAF was in 2001. Dive survey results show that no continuous-cover bark exists, and that discontinuous-cover bark is 0.08 acres. It is likely that large timber sale operators will load logs directly onto barges, which will greatly reduce the potential for additional bark accumulation. Some rafting of logs may be necessary during small timber sales to local operators due to the lack of equipment necessary to barge the logs. Due to the small amount of timber available for these sales, the increase in bark accumulation is likely to be minimal.

Transportation Management Direct / Indirect Effects

Transportation Management Direct / Indirect Effects Specific to Alternative 1 – No Action

This alternative would neither directly nor indirectly affect the transportation system. No new roads would be constructed under this alternative during this planning cycle, so no changes would be made to the current transportation system.

Transportation Management Direct / Indirect Effects Common to Alternatives 2, 3, 4, and 5

The effects of the transportation system on other resources are considered in the specific resource sections of this chapter. This section focuses on the effects of each alternative on the transportation system and discusses post-project access management.

In addition to NFS roads defined earlier, varying amounts of temporary road, also known as spur road, are proposed for construction. Temporary roads are roads authorized by contract (in this case a timber sale contract), permit, lease, or written authorization or emergency operation not intended to be part of the forest transportation system and are not necessary for long-term resource management (36 CFR 212.1). All proposed temporary roads would be decommissioned when no longer needed for the proposed timber sale that authorized their construction.

Table 3-64. Proposed road construction by action alternative (Forest Service GIS data)

Road Class	Alt 2 (miles)	Alt 3 (miles)	Alt 4 (miles)	Alt 5 (miles)
New NFS roads	3.1	4.7	3.9	4.3
New temporary roads	3.1	4.9	2.1	4.5
Total new roads	6.2	9.6	6.0	8.8
Existing roads in the project area	60.9	60.9	60.9	60.9
Total roads	**67.1**	**70.5**	**66.9**	**69.7**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Table 3-64 displays the miles of proposed roads by alternative. Alternative 4 has the fewest miles of new NFS and temporary roads with 3.9 miles of NFS, and 2.1 miles of proposed new temporary roads. Alternative 3 proposes the highest mileage of NFS and temporary roads of all the action alternatives with 4.7 miles of new NFS roads and 4.9 miles of new temporary roads. Alternative 2 proposes 3.1 miles of new NFS roads and 3.1 miles of new temporary roads. The new NFS road mileage totals for Alternatives 3, 4, and 5 include 0.2 miles of existing unauthorized road that are being added to the system. This caused the new NFS road totals for Alternatives 3 and 4 to increase by 0.2 miles between the DEIS and the FEIS. In June of 2005 Forest Service personnel conducted additional field surveys of karst features (Baichtal, 2005, pers. com.) and proposed road locations (Emley, 2005, pers. comm.). A number of roads were relocated to avoid high vulnerability karst and individual karst features. See Table 1-2 for a list of the NFS roads that were relocated. The relocations

caused the NFS road construction totals to increase 0.8 – 1.0 miles (depending on alternative) and decreased the amount of temporary road of .60 – 1.0 miles. Table 3-65 displays the new NFS and temporary road totals by alternative. Table 3-65 displays the individual and total new NFS roads proposed for the Tuxekan Project.

Table 3-65. NFS roads by action alternative (Forest Service GIS data)

Proposed Road	Alt 2 (miles)	Alt 3 (miles)	Alt 4 (miles)	Alt 5 (miles)
1460005	0.1	0.1	0.1	0.1
1460015	0.2	0.2	0.2	0.2
1460320	0.6	0.6	0.1	0.6
1460900	0.2	0.2	0.2	0.2
1470000	1.8	1.8	1.8	1.8
1470131	0.2	0.2	0.2	0.2
1470200	NA	0.4	0.4	NA
1470320	NA	0.9	0.9	0.9
1470330	NA	0.4	NA	0.4
Total new NFS roads	**3.1**	**4.8**	**3.9**	**4.4**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Road Reconstruction

Based on the 2001 Roads Rule, the definitions of road reconstruction and maintenance have changed. The original roadwork proposals and analysis for Tuxekan were completed about the same time (2001) as the Roads Rule. Since it typically takes a year or more to fully interpret and implement new regulations across the agency, the Thorne Bay Ranger District did not choose to change the roadwork proposal as a part of the DEIS issued in December 2004. Since that time, the national forests have received clearer guidance and have chosen to implement these changes. Specifically, the roadwork package that was proposed under the DEIS included approximately 31 miles of road reconstruction. As a result of interpretation of the Roads Rule, approximately 29 miles are now considered to be road maintenance. Approximately 23 miles of the 29 miles of road maintenance have been implemented on the ground and are considered as part of the existing condition for the project area. The road maintenance on Tuxekan Island that was scheduled in 2004 and performed in 2004/2005 was done to 1) maintain environmental compliance; and 2) ensure continued administrative access. An estimated 6 miles of road that are planned for use will receive pre-haul maintenance or reconditioning prior to timber sale operations. Maintenance and reconditioning of existing National Forest System (NFS) roads is an ongoing process that occurs on a periodic basis. The maintenance and reconditioning of NFS roads on Tuxekan Island may be implemented before, during, and after the NEPA process through separate service contracts. Regular maintenance reduces the backlog of deferred maintenance; reconditions roads to comply with best management practices; and maintains the existing infrastructure for the proposed timber sale, future harvest entries and other National Forest management activities

Proposed road management for the Tuxekan Project also involves reconstructing some existing roads within the project area. Road reconstruction is defined in the 2001 Roads Rule

as "Activities that result in improvement or realignment of an existing NFS road". Alternatives 3 and 5 propose 2 miles of road reconstruction that would consist of some minor realignment of the existing road, and culvert or bridge replacement. Existing roads or segments of roads not requiring reconstruction generally need some form of pre-haul maintenance, such as blading and shaping of the existing road surface, drainage repairs, roadway brushing and spot resurfacing.

Rock Pits

Existing rock pits would be used where possible to supply aggregate used in the construction of new roads. Any new rock pits would follow applicable standards and guidelines, best management practices, and visual quality objectives. Any potential rock pits would be located a sufficient distance from high-vulnerability karst areas to mitigate potential impacts from blasting. Streams and wetlands would also be avoided when locating rock quarries.

Access Management

After the completion of harvesting activities, roads are managed as necessary to control the type of use and kind of traffic. This is referred to as access management. Road access is managed to prevent damage to the roadway and to meet objectives for resources such as fish, water quality, and wildlife, while maintaining public uses and access for timber management and related activities. The Thorne Bay Ranger District's access management program includes public and agency involvement and interagency evaluation of road management objectives. The road system within the Thorne Bay Ranger District is essential for forest use and provides access for recreation, subsistence, and commodity uses. The road system needs to provide access that best serves the current and anticipated land management objectives and public uses. In addition to promoting environmental protection and values, the road system needs to be managed within current and expected funding levels (USDA FS 2000a). The management of the road system affects other factors such as subsistence and recreational uses of the area.

The responsible official for this project seeks to balance these public desires while allowing equal consideration to available funding, resource protection, and the desired condition of the area. Because of the levels of available funding and the extent of public comment, the management plan may not be fully implemented for several years or may be altered as a result of these and other factors.

The amount of available funding for new roads within National Forests has received considerable attention in recent years. As a result of changing financial capabilities and the need to reverse adverse ecological impacts associated with roads, greater emphasis is being placed on reconstructing and maintaining NFS roads while decommissioning unnecessary NFS and unauthorized roads. This emphasis has culminated in the development of a policy governing the National Forest transportation system. The Road Management Policy was published in the Federal Register on January 12, 2001, and addresses the need for greater emphasis on a more efficient and economical way of managing NFS roads.

The Road Management Policy (and Final Rule) stresses the need to more efficiently manage funds available for road construction, reconstruction, maintenance, and decommissioning. The Final Rule removes the emphasis on transportation development and adds a requirement for science-based transportation analysis. Combined with the Road Management Policy, the intended effect of the Final Rule is to help ensure that additions to the NFS network of roads

are those deemed essential for resource management and use; that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and, finally, that unneeded roads are decommissioned and restoration of ecological processes is initiated (USDA FS 2000a). The proposed access management plan represents a starting place for discussions regarding road management. In the development of the proposed access management plan for the Tuxekan project area; this EIS follows the direction of the Road Management Policy and Final Rule.

Travel Management Strategy

The travel management strategy for each NFS road within the Tuxekan project area can include one or more of the following categories:

- **Encourage:** Motor vehicle use is encouraged by appropriate signage, public notification, and active maintenance of the road prism.
- **Accept:** Motor vehicle use is allowed but not encouraged, while the road is maintained for administrative access.
- **Discourage:** Motor vehicle use is discouraged by allowing alder growth at road entrance, nonremoval of windthrow, or road prism deterioration within acceptable environmental limits (depending on designated maintenance level). To discourage use, the road may also be signed as “not maintained for motor vehicle traffic.”
- **Eliminate:** Motor vehicle use is eliminated by physically blocking the road. Where prescribed for long-term intermittent roads, this strategy is achieved by placement of impassable barricades at road entrances. On short-term roads, removal of drainage structures effectively blocks vehicle traffic.
- **Prohibit:** Motor vehicle use is prohibited by a road order (Code of Federal Regulations [CFR] closure). Implementation of this strategy on remote road systems may require installation of gates, public notification, and appropriate signing.
- **Prohibit seasonally:** Motor vehicle use is prohibited at times during the normal operating year. Seasonal prohibitions could be used as necessary to mitigate or control impacts on wildlife and subsistence resources. Administrative and permitted use of the roads would continue during closure periods, but only for specific permitted uses. Seasonal closures could be used in combination with cooperative efforts of fish and game protective agencies.

Where access is restricted, the travel management strategy, in general, would be to “eliminate” rather than “prohibit” road use. Access to roads under Forest Service jurisdiction can be restricted by regulation (36 CFR 212.7 and 261). In this case, applicable law confers a statutory right allowing entrance to public lands to search for minerals and to access mining claims. However, miners and prospectors would be required to obtain a permit to use restricted roads. Formal CFR road closures (prohibiting use) are not currently planned for any roads but could be required in the future.

Access to newly entered drainages would be discouraged or eliminated to minimize resource impacts, unless ongoing silvicultural work requires access to the area. In the latter case, it is anticipated that non -administrative road uses would be incidental to the ongoing silvicultural activities.

To meet access management objectives (primarily to reduce maintenance costs and offer enhanced protection for wildlife), all new NFS roads built for timber harvesting would be

placed in storage after the completion of harvest activities, eliminating all vehicle access. All proposed temporary roads would be decommissioned following harvest activities, eliminating all vehicular access. Depending on the alternative selected, 6.2 miles (Alternative 2), 9.6 miles (Alternative 3), 6.0 miles (Alternative 4), and 8.8 miles (Alternative 5) of newly constructed roads would be closed to vehicular access. All proposed roads would continue to allow hike-in access to obtain subsistence resources or participate in recreation activities. Table 3-66 provides more detailed information about Forest Service Road Management Objectives (RMOs), and Table 3-67 displays the proposed access management plan for the Tuxekan Project.

Table 3-66. Forest Service Road Management Objectives

	Open (Active Maintenance)	Stormproof	Store	Decommission
Definition	Road is maintained for vehicle use.	Design standards on system roads will meet a 25 year storm event. Stormproofing will not prohibit vehicle traffic, but will restrict traffic to vehicles with high-clearance capabilities. Considered an open road, not a closed road, with mitigation measures implemented to ensure longevity of the road.	Stabilizing a road segment to withstand a 25-year storm event. Storage will prevent vehicle access into the stored section of road.	Closing a road segment to all vehicle traffic for an extended period of time, along with stabilizing the road segment so no additional maintenance will be required. Equivalent to techniques outlined in BMP 14.24.
AFRPA Status[a]	Active	Inactive	Closed	Closed
Maintenance Level	2 or 3	1 or 2, depending on the extent of stormproofing.	1	N/A - road is removed from Forest Service database.
Traffic Management Strategy	Either encourage passenger vehicles or accept either passenger or high-clearance vehicles.	Either discourage or prohibit passenger cars or accept or discourage high- clearance vehicles.	Either eliminate or prohibit all vehicle access.	Either eliminate or prohibit all vehicle access.
Requirements	Excavate additional drainage ditches (water bars) to help provide drainage relief to all existing drainage structures. Clean ditches. Stabilize all cut and fill slopes that are susceptible to extensive soil erosion.	Excavate additional drainage ditches (water bars) to help provide drainage relief to all existing drainage structures. Clean ditches. Stabilize all cut and fill slopes that are susceptible to extensive soil erosion. No extensive use is planned for the road for up to 10 years. Roads will reduce the risk of hydrological failures caused by limited long term maintenance.	Remove all water quality and fish passage stream crossings. Clean ditches. Stabilize all cut and fill slopes that are susceptible to extensive soil erosion. Scarify road to completely eliminate vehicle	Make road hydraulically neutral on the landscape. Clean ditches. Stabilize all cut and fill slopes that are susceptible to soil erosion. Scarify road to completely eliminate vehicle traffic.
Rationale	Road will be used for public and/or administrative uses.	No extensive use is planned for the road for up to 10 years. Roads will reduce the risk of hydrological failures caused by limited long term maintenance.	No extensive use is planned for the road for up to 50 years. Storing will eliminate any extensive road maintenance requirements due to the number of fish passage and significant water quality stream crossings, thus making the road “hydrologically maintenance free.”	Criteria for decommissioning roads includes: Infrastructure that is not needed for 50 or more years; Short segments of road (less than 1,000 feet) with high resource concerns; and Roads located on nondevelopment land use designation (e.g., road currently inside an old-growth habitat reserve).

Source: FSM 7712.5 Road Management Objectives

[a] AFRPA - Alaska Forest Resources and Practices Act

Table 3-67. Tuxekan Project proposed access management plan

Road Number	Total Length (miles)	Length Closed [a] (miles)	Traffic Service Level [d]	Proposed Maintenance Level [c]	Closure Reason	Travel Management Strategy	Forest Service Treatment	AFRPA[b] Status
1460000	7.94	0.00	C	2	n/a	Accept	Open	Active
1460005*	0.15	0.15	D	1	Economics, wildlife	Eliminate	Storage	Closed
1460015	0.20	0.20	D	1	Economics, wildlife	Eliminate	Storage	Closed
1460030	0.92	0.92	D	1	Economics, wildlife	Eliminate	Storage	Closed
1460100	2.39	0.41	C	2	n/a	Accept	Stormproof to MP 1.98	Inactive
1460100	2.39	0.41	D	1	Economics, fish	Eliminate	Storage MP 1.98 to end	Closed
1460250	0.31	0.31	D	1	Economics, wildlife	Eliminate	Storage	Closed
1460300	1.79	1.79	D	1	Economics, wildlife	Eliminate	Storage	Closed
1460320	0.59	0.59	D	1	Economics, wildlife	Eliminate	Storage	Closed
1460500	0.21	0.21	D	1	Economics, wildlife	Eliminate	Storage	Closed
1460900	0.17	0.17	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470000	1.96	1.96	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470000	10.35	0.00	C	2	n/a	Accept	Open	Active
1470010	0.18	0.00	C	2	n/a	Accept	Open	Active
1470020	1.14	1.14	D	1	Economics, wildlife	Eliminate	Storage	Inactive
1470030	0.74	0.74	D	1	Economics, wildlife	Eliminate	Storage	Inactive
1470030	0.74	0.32	D	1	Economics, wildlife	Eliminate	Storage MP 0.42 to end	Closed
1470100	1.31	1.31	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470110	0.58	0.58	D	1	Economics	Eliminate	Storage	Closed
1470130	1.99	1.99	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470131	0.16	0.16	D	1	Economics	Eliminate	Storage	Closed
1470200	0.23	0.23	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470200	1.08	1.08	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470300	2.04	0.90	C	2	n/a	Accept	Stormproof to MP 1.14	Inactive
1470300	2.04	0.90	D	1	Economics, wildlife	Eliminate	Storage MP 1.14 to end	Closed
1470320	0..88	0.88	D	1	Economics, wildlife	Eliminate	Storage	Closed

Table 3-67. Tuxekan Project proposed access management plan

Road Number	Total Length (miles)	Length Closed [a] (miles)	Traffic Service Level [d]	Proposed Maintenance Level [c]	Closure Reason	Travel Management Strategy	Forest Service Treatment	AFRPA[b] Status
1470330	0.64	0.64	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470330	0.40	0.40	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470400	1.12	1.12	D	1	Economics	Eliminate	Storage	Closed
1470500	4.10	3.05	C	2	n/a	Accept	Stormproof to MP 1.05	Inactive
1470500	4.10	3.05	D	1	Economics	Eliminate	Storage MP 1.05 to end	Closed
1470570	0.88	0.88	D	1	Old Growth Reserve	Eliminate	Storage	Closed
1470600	1.20	1.20	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470610	0.23	0.23	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470650	0.39	0.39	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470800	0.53	0.53	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470810	0.10	0.10	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470820	0.37	0.37	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470000_4.92R	0.13	0.13	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470200_1.00L	0.14	0.14	D	1	Economics, wildlife	Eliminate	Storage	Closed
1470820_0.2L	0.14	0.14	D	1	Economics, wildlife	Eliminate	Storage	Closed

[a] Total closed length may not agree with other data presented in the text due to rounding errors.

[b] AFRPA - Alaska Forest Resources and Practices Act

[c] Maintenance Level 1: Assigned to intermittent service roads during the time they are closed to vehicular traffic. Maintenance Level 2: Roads are maintained for high-clearance vehicles and monitored for resource protection.

[d] Traffic Service Level C: Flow interrupted – use limited. Traffic Service Level D: Slow flow or may be blocked.

* Underlining indicates new construction

The existing road condition survey for roads on the haul route would be reviewed and additional site-specific requirements determined during sale preparation for inclusion in timber sale contracts. Additional road condition surveys would be conducted on unauthorized roads to determine work necessary. Other funding sources would be needed for roads not on haul routes or within ¼ mile of sale areas. Following the implementation of the proposed access management plan, existing roads on NFS land would be left open or closed as a result of Forest Plan direction and compliance with the recent Roads Rule. Many of the proposed closures would be on roads that are currently not drivable and therefore would have no impact on current access. Following implementation of the proposed access management plan, 22 miles of existing roads on NFS lands would remain open to both passenger and/or high-clearance vehicle use, of which 4.3 miles of existing roads would be stormproofed. A total of 22 miles would be available to both high-clearance and off-highway vehicles. Therefore, of the 36.6 miles of currently open and drivable roads on NFS lands within the project area, approximately 60 percent would remain open following the implementation of the proposed access management plan. Road closures would occur on approximately 19 miles of NFS road with 1.5 miles of unauthorized road decommissioned (removed from the Forest Service database). Approximately 23 percent of these road closures would occur on roads that are currently not drivable, therefore decreasing the likelihood of potential impacts to recreation and/or subsistence activities. The proposed access management plan will be implemented under all action alternatives. See Table 3-68 and Table 3-69 for a display of proposed project area road treatments.

Table 3-68. Treatment of existing roads under all action alternative

Treatment	Amount
Existing Roads in Project Area (miles)	60.9
Existing roads on National Forest System land (miles)	58.8
Existing roads on National Forest System land that are currently open and drivable (miles)	36.6
Percent of existing NFS roads on National Forest System land that are open and drivable.	89%
Existing NFS roads on National Forest System land proposed to be closed following harvest (miles)	19.0
Percent of existing NFS road proposed for closure.	46%
Miles of proposed road closure on NFS roads currently not drivable (miles)	4.4
Percent of proposed road closures on NFS roads currently not drivable.	23%
Existing NFS roads on National Forest System land proposed to be left open following harvest (miles)	22.0
Percent of existing NFS road proposed to remain open	54%
Percent of existing NFS roads on National Forest System land currently open/drivable that would remain open following harvest	60%

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Table 3-69. Treatment of proposed roads by action alternative

Treatment	Alt 2 (miles)	Alt 3 (miles)	Alt 4 (miles)	Alt 5 (miles)
Proposed roads to be left open	0.0	0.0	0.0	0.0
Proposed roads to be closed	6.2	9.6	6.0	8.8
Total proposed roads	**6.2**	**9.6**	**6.0**	**8.8**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Unauthorized Roads

Unauthorized roads are existing roads on NFS Lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1). In the Tuxekan project area, most of the existing unauthorized roads started as temporary roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization. Of the 58.8 miles of existing roads within NFS land in the project area, 41 miles are NFS roads and 17.8 miles are unauthorized roads (all roads located within non-NFS land are NFS roads). Following the completion of harvest activities, any existing unauthorized roads in the beach fringe and existing Forest Plan old-growth reserves (OGRs) are proposed to be decommissioned. An unauthorized road system southeast of Turn Point (not connected to the main road network) is proposed to be decommissioned. The remainder of the existing unauthorized roads will receive further analysis to decide whether to classify a road and add it to the system, or to decommission a road and remove it from the system. The unauthorized roads will receive a road condition survey to determine if work is needed to protect resources. This determination will be made at a later date by the Thorne Bay Ranger District after completion of the POW ATM plan.

Road Density

Current total road density (disregarding drivable and non-drivable road characteristics) on NFS land is 2.2 miles per square mile. The current open road density on NFS land is 1.4 miles per square mile. Following the completion of harvest activities, the decommissioning and storage of existing and proposed roads would decrease overall open road density to 0.8 miles per square mile. Because all proposed roads for the Tuxekan Project would be closed following harvest activities, open road density would not change based on project alternative and therefore would remain at 0.8 miles per square mile regardless of the chosen action alternative. See Table 3-70 and Table 3-71 for a display of existing road density and road density by action alternative during project implementation, prior to implementing the Proposed Access Management Plan.

Table 3-70. Existing road density

Density	Miles/Square Mile
Current total road density (disregarding drivable and not-drivable road characteristics) on National Forest System land (mi2)	2.2
Current open road density on NFS land (mi2)	1.4
After implementation of Proposed Access Management Plan open road density on National Forest System land (mi2)	0.8
After implementation of Proposed Access Management Plan open road density on all land in Project Area (mi2)	0.8

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Table 3-71. Projected road density by alternative

Density	Alt 2 (miles)	Alt 3 (miles)	Alt 4 (miles)	Alt 5 (miles)
Maximum total road density (disregarding drivable and not-drivable road characteristics) on National Forest System land (mi2) during project implementation.	2.5	2.6	2.4	2.6
Maximum open road density on National Forest System land (mi2) during project implementation.	1.6	1.7	1.6	1.7

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Transportation Management Cumulative Effects

The area considered for the analysis of cumulative effects for transportation management is the project area boundary. The cumulative effects time period includes transportation mangement activities that have taken place on Tuxekan Island beginning in the 1940s through the implementation of the Tuxekan project (2012). These temporal and spatial boundaries are considered, because the current transportation system is the result past activity within the project area, and includes all transportation systems needed for use by this project.

Transportation Management Cumulative Effects Specific to Alternative 1 – No Action

Because there would be no changes to the transportation system resulting in implementation of Alternative 1, there would be no cumulative effects to the transportation system.

Transportation Management Cumulative Effects Common to Alternatives 2, 3, 4, and 5

By closing existing roads that are currently not drivable, few or no impacts are expected regarding access to recreation and subsistence resources due to the lack of motorized use of these roads. Actions on non-NFS lands within the Tuxekan project area are not expected to impact the road system or access to places within the project area. Following harvest activities, open road density for the Tuxekan project area (including non-NFS lands) would change from the existing 1.4 miles per square mile to 0.8 miles per square mile. The current trend is to reduce the mileage of open roads to match available maintenance funds and the

needs for protection of other resources. The POW ATM plan is currently being developed, and will address road management for the Craig and Thorne Bay Ranger Districts. The plan includes the Tuxekan project area and will address future road management opportunities such as decommissioning of unauthorized roads.

Approximately 1.75 miles of road associated with a recent State timber sale on Tuxekan Island have been closed. Closure of State roads is synonymous with decommission for Forest Service roads. Since this road has been closed, it does not add to the density of open roads on the island. Hunters and other visitors can hike the roadbed if they want access to the State unit.

Since many of the units that were logged in the 1940s are not accessed by the existing road network, additional roads would likely be built into the stands. The amount and location of the roads would depend on a site-specific reconnaissance that would occur during the planning of a commercial thinning project sometime in the future. The current philosophy for access management is to decommission temporary roads and to store new NFS roads. The open road density should not increase as a result of future commercial thinnings, should they be planned and implemented (currently, no plans exist).

There would be a permanent loss of rock resource within the project area due to the proposed road construction in Alternatives 2, 3, 4, and 5. Based on an estimates of 9,000 cubic yards of rock per mile of construction for temporary road and 11,000 cubic yards for specified road, Alternative 2 would require approximately 62,000 cubic yards, Alternative 3 96,200 cubic yards, Alternative 4 58,200 cubic yards, and Alternative 5 88,200 cubic yards.

Biological Environment

Vegetation Management

Silviculture is the art and science of controlling the establishment, growth, composition, health, and quality of forests to meet the diverse needs and values of landowners and society on a sustainable basis (Helms, 1998). Silvicultural treatments may include tree planting, thinning, removal of diseased or dead trees (sanitation/salvage), and regeneration harvesting of mature stands to establish new stands. The analysis area for timber and silviculture is the National Forest System (NFS) lands on Tuxekan Island. The cumulative effects area for timber and silviculture is the National Forest System lands on Tuxekan Island.

Methodology for Analysis

The following discussions and analyses are based on maps, queries, stand exam (inventory) data, preliminary silvicultural prescriptions, and other documentation available in the planning record. Many of these data exist electronically in the Tongass' GIS database and Natural Resource Information System (NRIS-FSVeg), where stand inventory data is housed. Units proposed for treatment were inventoried in 2000, using standard procedures outlined in Tongass supplements to the Forest Service Handbook. Alternatives are compared with regard to how well each would move stands toward the desired conditions. Indicators used for comparison include:

- Acres regenerated and placed under management aimed at timber production
- The expected species composition of new stands

- Stand size class distribution in the project area is compared
- Effects on forest health
- Understory plant development

Vegetation Management Affected Environment

Timber harvesting in the analysis area began in the 1920s and continued into the 1990s. Second-growth stands resulting from past harvesting cover about 7,844 acres, which accounts for approximately 46 percent of the original productive old growth (POG) within the analysis area. Currently, the National Forest System lands within the analysis area include about 8,633 acres of POG, much of which is located in the development land use designation (LUD) timber production. Other lands within the analysis area were removed from the timber production LUD through management direction established by the 1997 Forest Plan (USDA FS 1997a) and accompanying 1997 Record of Decision (ROD). These include the Old-growth Habitat LUD and areas classified as high-vulnerability karst lands, riparian buffers, steep slope areas, and areas where land ownership has changed. The remaining suitable and available timber in the analysis area is 3,738 acres.

Description of the Timber Resource

The initial scoping map sent out for public input identified 51 potential harvest units. Of those original numbered units, 12 were eliminated following field reconnaissance for the following reasons. Nine units were deleted to meet Forest Plan Standards and Guidelines related to suitability for harvest. Major portions of the nine units were mapped in revised Old-growth Habitat, the beach fringe, or on a revised Riparian Management Area (RMA) location. Several of the nine units had been substantially harvested in past salvage sales and were not economically feasible to reenter at this time. Three units were combined with adjacent units and although the unit number was deleted from the list the acreage remained available for consideration in the action alternatives. As described in Chapter 2, five units were deferred at this time by the IDT leaving a maximum of 34 units for the alternatives (see Appendix G, “Alternative Development Process,” for more on the unit pool). The 34 units are old growth or mature timber types typical of Southeast Alaska. The primary species are western hemlock (*Tsuga heterophylla*) (72 percent), Sitka spruce (*Picea sitchensis*) (18 percent), mountain hemlock (*Tsuga mertensiana*) (less than one percent), western redcedar (*Thuja plicata*) (10 percent), and Alaska yellow-cedar (*Chamaecyparis nootkatensis*) (less than one percent). Despite the low amount of Alaska yellow-cedar in the analyzed units, it is present on Tuxekan Island.

Productive forest lands are those timbered National Forest System lands not withdrawn from timber harvesting that are capable of producing at least 20 cubic feet per acre per year, and have at least eight thousand board feet (mbf) per acre. The surveyed units in the Tuxekan analysis area are classified as high- and medium- volume strata (85 percent high, 15 percent medium) and, therefore, meet the productive forest land criteria.

Timber harvesting in the analysis area would take place in the timber production LUD. The summary goals and objectives for this LUD are listed in Chapter 1.

The desired condition for this LUD includes continued production of wood products on a long-term sustained-yield basis, which contributes to a Forest-wide sustained yield.

Various natural phenomena affect the life cycle of forest trees, which experience damage, decay, and eventual death. Table G-1 in Appendix G shows the occurrence and relative severity of damage for each of the major damaging agents in the current unit pool. These damaging agents can be separated into biotic and abiotic agents.

Of the biotic agents, insects and animals are only minor damaging agents in the analysis area. Dwarf mistletoe is present in all old-growth units in the Tuxekan Analysis Area. Many of the units included in the unit pool were rated low for the occurrence of dwarf mistletoe. Twelve units in the current unit pool were rated moderate, and two were rated moderate-high (Appendix G, Table G-1). Decay-causing fungi are present in all stands within the analysis area. Three units in the current unit pool were rated high for the occurrence of decay fungi. The remaining units were rated moderate or low.

The major abiotic damaging agent is windthrow. In the Tuxekan analysis area, high or very high windthrow hazard generally occurred in areas with exposure due to topography or adjacent logging. Thirty of 36 units (83 percent) are rated moderately high, high, very high, or extremely high for windthrow potential. Table G-1 provides the windthrow potential for each unit in the current unit pool.

Vegetation Management Mitigation Measures

No specific mitigations are necessary to address issues regarding silviculture and timber management. It is understood that standard timber sale contract language would be included in any sales that result from this project. Standard contract provisions adequately protect residual stands from excessive damage.

Implementation monitoring and results monitoring would include the following activities if an action alternative were selected. Specialists would review final harvest unit design for consistency with requirements of the Decision. Timber designation and cruising would be reviewed by qualified check cruisers. Timber sale contracts are monitored for contract compliance. Timber sale contract administration is a rigorous activity, which monitors all aspects of the timber sale purchaser’s work. Post harvesting review would be conducted by a silviculturist to verify that desired results were achieved. At the end of the third full growing season after harvest, a walk-through examination of seedling establishment and species composition would be conducted. Years of experience with even-age regeneration harvest methods allows a confident prediction that walk-through examinations will be sufficient to determine regeneration establishment. Units harvested using uneven-aged methods would be monitored periodically for general forest structure, species composition including under-represented species, especially in the understory, logging damage, windthrow, disease, and growth. These results would contribute to the Forests knowledge of and experience with uneven-aged regeneration methods.

Vegetation Management Direct and indirect Effects

Silvicultural Prescriptions

A silvicultural prescription is a planned treatment or series of treatments designed to change the current stand structure to one that better meets management goals. Several silvicultural prescriptions were considered for the analysis area. These were necessarily constrained by operational considerations as well as provisions for the conservation of marten and goshawk

habitat. The silvicultural prescriptions considered were the uneven-aged, single-tree selection method (STS) and the two-aged clearcut with reserves method (CCR)[4,5].

Single Tree Selection

Individual trees designated by species and diameter ranges are removed as they occur in the unit. This method promotes growth of the remaining trees and provides space for regeneration. Regeneration is expected to develop a young cohort in the gaps, resulting in a stand that is a mosaic of multiple age classes (uneven-aged). In the Tuxekan analysis area, the STS prescription was applied where the risk of windthrow was acceptable, a light removal of timber was desirable for other resource concerns (e.g., wildlife and karst), and reasonable economic returns could be achieved. Generally, less than 25 percent of the stand basal area is designated for harvesting in this entry. As an uneven-aged management system, prescriptions will schedule subsequent entries at roughly 50-year intervals, and prescribe about 25 percent basal area removal at each entry. The STS prescription is often associated with helicopter and uphill cable logging systems where operational concerns can be met. Some STS units include no-harvest reserve areas. These reserved areas are designed to achieve resource goals such as eliminating harvesting on high vulnerability karst and steep slopes. The areas are reclassified as unsuitable for timber harvesting, the reserves last in perpetuity, and the land is removed from the suitable land base. Reclassification follows field reconnaissance of the originally planned harvest unit.

Clearcut with Reserves

Varying numbers of green trees are retained, either individually or in groups, for management objectives other than regenerating the stand. In the Tuxekan analysis area the CCR prescription was applied primarily to reduce windthrow potential in remaining stands, meet marten and goshawk standards and guidelines utilizing the 1:1 acre ratio for retention in large patches, regenerate desired tree species such as Sitka spruce, improve economics, and be compatible with standard logging systems. Clearcuts with reserves result in two-aged regenerated stands (USDA Forest Service 2006) with about half the acreage deferred from harvesting at this time. In the harvested portion of the unit, 10 percent or more of the original stand structure, is retained. Adequate amounts of downed woody material are left after harvesting. In the no-harvest portion of each unit, 100 percent of the original stand structure is retained for other resource concerns. The combination of harvesting and no-harvest areas results in at least 30 percent canopy closure for the unit area as a whole. The no-harvest deferral areas include lands in the suitable timber base. Reserve areas are reclassified as unsuitable land following reconnaissance of the originally planned harvest unit. The Sitka spruce component and western redcedar component are expected to increase in the harvested area, because they respond well to the increased light and temperatures offered by clearcut sites and seedling establishment is best on areas with at least some exposed mineral soil

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[4] The DEIS used the term "Clearcut with Reserves" or "CCR" throughout, and referred to this prescription as an even-aged management method. A May 11, 2005 Supplement to the Forest Service Manual for Region 10 (Alaska Region) attempted clarification regarding certain terminologies. At FSM R-10 Supplement 2400-2005-1, 2470.5, Definitions, the clearcutting method with reserves (CCR) is defined as a clearcut method that will result in two-aged management.This change is only a change in terms, and is not a change in actual prescribed treatments planned to be applied.

[5] One unit, 587.2-417, at two acres total size, does not require structural retention for goshawk and marten. As such, it would be a clearcut, even-aged management, by definition. Given the extremely small size, and given that effects are identical to those of the harvested portions of the CCR units, for all purposes in this EIS, it's 2 acres are combined with those of the CCR units for analysis purposes. The unit card in appendix B lists this as a clearcut, not CCR.

(Forest Plan, Appendix G). Dwarf mistletoe in western hemlock is discouraged by clearcutting, because the mistletoe seed source is eliminated. To increase windfirm edges, especially on the leeward side of units, placing the harvest area adjacent to low-volume stands or muskegs or feathering the edge of the harvest unit increases the stability of boundary trees.

Criteria for Selection of Silvicultural Prescription

The criteria used to select the appropriate silvicultural prescription for each unit include the following:

- Operational feasibility (possible logging systems, access, reserve tree guidelines for woods-worker safety)
- Economics, including consideration of sale viability
- Windthrow hazard (the presence of tree and stand attributes determining windthrow potential)
- Stand conditions (diseases and decay fungi, volume, values, species composition)
- Regeneration potential
- Special habitat considerations (marten and goshawk habitat requirements)

Where there was a reasonable expectation that the windfirm nature of a stand could be maintained, the STS prescription was considered. Table 3-72 displays the number of acres that would be treated under each action alternative. STS prescription was applied where the risk of windthrow was acceptable, a light removal of timber was desirable for other resource concerns (e.g., wildlife and karst), and reasonable economic returns could be achieved. These reasons justify its use over the use of CCR.

Table 3-72. Acres treated by silvicultural prescription for Alternatives 2, 3, 4, & 5 (Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database)

Unit Number	Planned Unit	Clearcut With Reserves	Single-tree Selection	Areas Deferred or Reserved From Harvesting
Alternative 2				
556-409	77	38	0	39
556-410	10	0	10	0
556-412	NA	NA	NA	NA
556-451	25	0	14	11
556-452	NA	NA	NA	NA
557-402	38	19	0	19
557-403	13	6	0	7
557-404	12	6	0	6
557-405	13	5	0	8
557-426	29	0	28	1
557-427	4	2	0	2
557-433	NA	NA	NA	NA
560-401	84	42	0	42
560-402	36	18	0	18
560-403	93	41	0	52
560-404	14	4	0	10
560-405	58	29	0	29
560-406	76	38	0	38
560-407	NA	NA	NA	NA
560-408	NA	NA	NA	NA
560-409	NA	NA	NA	NA
560-411	NA	NA	NA	NA
560-412	57	0	26	31
560-416	NA	NA	NA	NA
560-417	NA	NA	NA	NA
560-426	17	8	0	9
560-428	39	19	0	20
587.2-412	8	4	0	4
587.2-413	42	21	0	21
587.2-414	35	17	0	18
587.2-417	2	2	0	0
587.2-419	63	12	0	51
587.2-424	48	24	0	24
587.2-425	20	10	0	10
Totals	**913**	**356**	**78**	**470**

Table 3-72. Acres treated by silvicultural prescription for Alternatives 2, 3, 4, & 5 (Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database)

Unit Number	Planned Unit	Clearcut With Reserves	Single-tree Selection	Areas Deferred or Reserved From Harvesting
Alternative 3				
556-409	77	38	0	39
556-410	10	0	10	0
556-412	34	17	0	17
556-451	25	0	14	11
556-452	18	9	0	9
557-402	38	19	0	19
557-403	13	6	0	7
557-404	12	6	0	6
557-405	13	5	0	8
557-426	29	0	28	1
557-427	4	2	0	2
557-433	64	16	0	48
560-401	84	42	0	42
560-402	36	18	0	18
560-403	93	41	0	52
560-404	14	4	0	10
560-405	58	29	0	29
560-406	76	38	0	38
560-407	27	8	0	19
560-408	45	15	0	30
560-409	50	24	0	26
560-411	60	11	0	49
560-412	57	0	26	31
560-416	13	6	0	7
560-417	49	24	0	25
560-426	17	8	0	9
560-428	39	19	0	20
587.2-412	8	4	0	4
587.2-413	42	21	0	21
587.2-414	35	17	0	18
587.2-417	2	2	0	0
587.2-419	63	12	0	51
587.2-424	48	24	0	24
587.2-425	20	10	0	10
Totals	**1,273**	**495**	**78**	**700**

Table 3-72. Acres treated by silvicultural prescription for Alternatives 2, 3, 4, & 5 (Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database)

Unit Number	Planned Unit	Clearcut With Reserves	Single-tree Selection	Areas Deferred or Reserved From Harvesting
Alternative 4				
556-409	77	38	0	39
556-410	NA	NA	NA	NA
556-412	NA	NA	NA	NA
556-451	25	0	14	11
556-452	NA	NA	NA	NA
557-402	38	19	0	19
557-403	13	6	0	7
557-404	12	6	0	6
557-405	13	5	0	8
557-426	29	0	28	1
557-427	4	2	0	2
557-433	64	0	16	48
560-401	84	42	0	42
560-402	36	18	0	18
560-403	NA	NA	NA	NA
560-404	14	4	0	10
560-405	58	29	0	29
560-406	NA	NA	NA	NA
560-407	27	8	0	19
560-408	45	0	15	30
560-409	NA	NA	NA	NA
560-411	59	10	0	49
560-412	57	0	26	31
560-416	13	6	0	7
560-417	49	24	0	25
560-426	NA	NA	NA	NA
560-428	NA	NA	NA	NA
587.2-412	NA	NA	NA	NA
587.2-413	NA	NA	NA	NA
587.2-414	35	17	0	18
587.2-417	2	2	0	0
587.2-419	63	12	0	51
587.2-424	48	24	0	24
587.2-425	20	10	0	10
Totals	**885**	**282**	**99**	**504**

Table 3-72. Acres treated by silvicultural prescription for Alternatives 2, 3, 4, & 5 (Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database)

Unit Number	Planned Unit	Clearcut With Reserves	Single-tree Selection	Areas Deferred or Reserved From Harvesting
Alternative 5				
556-409	77	38	0	39
556-410	10	0	10	0
556-412	35	17	0	17
556-451	25	0	14	11
556-452	NA	NA	NA	NA
557-402	38	19	0	19
557-403	13	6	0	7
557-404	12	6	0	6
557-405	13	5	0	8
557-426	29	0	28	0
557-427	4	2	0	2
557-433	63	14	0	49
560-401	84	42	0	42
560-402	36	18	0	18
560-403	93	41	0	52
560-404	14	4	0	10
560-405	58	29	0	29
560-406	NA	NA	NA	NA
560-407	27	8	0	19
560-408	45	15	0	37
560-409	50	25	0	25
560-411	60	10	0	50
560-412	57	0	26	31
560-416	13	6	0	7
560-417	49	24	0	25
560-426	17	8	0	14
560-428	39	15	0	24
587.2-412	8	4	0	4
587.2-413	42	21	0	21
587.2-414	35	17	0	18
587.2-417	3	2	0	1
587.2-419	63	12	0	51
587.2-424	48	24	0	24
587.2-425	20	10	0	10
Totals	**1,180**	**442**	**78**	**670**

The "30 percent" prescription

The Forest Plan Standards and Guidelines for goshawk and marten describe a desired stand condition of 30 percent or more canopy coverage uniformly distributed across entire units. The same standards and guidelines allow an alternative to the uniform distribution method, where a 1:1 acreage ratio is used to create an average of 30 percent canopy across the unit. In this situation the 1:1 ratio is a part of the CCR prescription. This alternative was used, rather than the even "30 percent" distribution method primarily for concerns with windfirmness in the remaining stand. There is little experience or research in Southeast Alaska with partial cutting to this level of retention. A reasonable assurance of windfirmness cannot be provided. There are several recent examples of 30 percent canopy retention prescriptions failing to maintain adequate cover for even a few years. Early results (unpublished research, McClellan) and experience in other wind-driven systems suggest that partial cuts might remain windfirm with 70 to 75 percent or more retention, but as retention is reduced below that, losses to wind increase substantially. On the other hand, there is considerable experience and expertise in Southeast Alaska with the effects of wind on clearcuts and clearcut edges. With this experience, and guidelines for application of windfirm buffers, a reasonable assurance of windfirmness can be provided for the CCR and STS prescriptions. In CCR units, where 10 percent (minimum) structure is required, prescriptions will target a range of 10 to 20 percent structure retention, realizing that losses may occur even there.

The CCR prescription has certain other advantages over the 30 percent retention prescription. In many instances road lengths to access a CCR unit can be shorter, and cost less, than to access an entire unit. While it is theoretically possible to shovel-log a partial cut prescription, in practice it becomes difficult in all but ideal conditions. The reserve tree guidelines for woods-worker safety make it difficult to retain the desired amounts of reserve trees in the 30 percent retention prescription while maintaining reasonable economics for a unit. Old growth habitat is reasonably well assured to remain in tact with the 1:1 CCR prescription, because entire patches are retained, unaffected by any harvest, and likely to stand against the wind. In contrast, a 30 percent retention harvest would affect an entire unit, first with logging, then, in all reasonable likelihood, the remaining standing structure would be lost to windthrow. In that case, no old growth conditions would remain.

Species Composition and Harvesting of Cedar

Based on stand examination data, approximately 90 percent of the stands sampled for the Tuxekan project are western hemlock and Sitka spruce (72 and 18 percent respectively). Western red cedar accounts for approximately ten percent of the stands. Although no Alaska yellow-cedar occurred in the stand examination plots, Alaska yellow-cedar is present on the island, and scattered individuals may be present in harvest units. The cedar component of the stands sampled for the Tuxekan Project is less than the average for the southern end of the Tongass (previously known as the Ketchikan Area). The cedar component of available timberlands on the southern end of the Tongass is approximately 22 percent with western redcedar at 12.5 percent and Alaska yellow-cedar at 9.5 percent (Wilson 2002).

The percentage of cedar proposed for harvesting varies somewhat between alternatives. CCR prescriptions have little influence on the variation between alternatives. Cedar usually occurs as a minor species in mixed conifer stands and for CCR harvesting areas, average stand conditions are used to calculate species composition and volume. The positioning of reserve

areas and other resource concerns dominated choices during alternative formulation. It would be extremely difficult to target cedar for harvesting when designing CCR units.

Single-tree selection prescriptions can influence the amount of higher value species such as spruce and cedar that are harvested. The STS prescriptions are intended to result in a lighter touch on the land. To accomplish this goal, the units need to be economically and operationally feasible. The STS prescription designates species and diameter ranges within the species. As a result, the relatively low number of trees harvested is of higher value per tree than the average for the stand. Trees that do not meet the diameter and species requirements remain as components of the stand and provide a seed source for regenerating the species.

Table 3-73. Percent of each species harvested by alternative

Species	Percent of Harvest				
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Hemlock	0	62	62	60	62
Spruce	0	17	17	17	17
Cedar	0	21	21	23	21

Source: Stand examinations and analysis in project record

Although Alternative 4 has the highest percent of its volume in cedar, the result is more related to the chance that cedar is in the units chosen to meet the intent of the alternative than a deliberate targeting of cedar (Table 3-73). Overall, alternative design tended to protect many of the higher volume hemlock/spruce stands that are typical of karst with high and moderate vulnerability by not including these stands for harvesting. The protection measures for karst and other resources can shift the species balance of alternatives.

Appendix E contains post-sale treatments designed to maintain the cedar component in harvested areas. Inter-planting of cedar and retaining cedar during thinning operations would improve species composition (future manipulation of the cedar component). In addition, STS prescriptions for this project do not call for the harvesting of Alaska yellow-cedar. Any Alaska yellow-cedar in the STS units could be left as a seed source.

Species composition in harvest areas is expected to be similar to that of the parent stand (Deal, 2002). None of the alternatives would cause a serious shift in species compositions in new, young stands.

Reductions in Lands Suitable and Available for Timber Production

Alternatives address old growth reserve strategies to varying degrees. The degree to which an old growth strategy improves ("protects") wildlife habitat conditions has a corresponding effect on options for future timber management, including harvest and regeneration. Each old growth strategy (see alternatives) reduces the net acreage of suitable and available timber production lands. These are explained in the wildlife sections and summarized in Table 3-74.

Table 3-74. Acres moved from suitable/available to OGR

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres moved from suitable/available status to OGR status	0	866	293	856	856

Source: Project GIS; "…smog_strategies_suitability"

Loss of Production from Roads

Permanent roads are not expected to become reforested, and are not expected to contribute to future timber production. Temporary roads are expected to be returned to timber production. Years of experience shows that temporary roads in fact do regenerate, often with spruce and cedar. While growth may be slower on these sites in the short term, the long-term effect is not known. A management decision to build, use and then close temporary roads recognizes this trade-off as a "cost" of managing timberlands.

Logging Systems

Logging is the process of conveying logs from the stump to the landing (the point at which they are loaded onto trucks for transport). This can be done using ground-based equipment, cable systems, or helicopters. The method used depends on many factors, including access, topography, slope, and resource protection needs (log suspension requirements). Appendix G describes these systems in more detail.

All logging would be conducted in conformance with Forest Plan Standards and Guidelines. Special yarding requirements for minimizing adverse effects are specified on the unit cards (see Appendix B). On-site ground reconnaissance and actual field evaluations during the planning and layout process would ensure that the assigned logging system provides the suspension required to meet management objectives.

Harvest acres by logging system for each alternative are shown in Table 3-75. Because there is only a small area of gentle terrain in the proposed units, there is only a minor amount of shovel logging proposed in each action alternative. The widely used, relatively economical running skyline system is proposed for 46 to 63 percent of the harvest acres. Where the terrain dictates downhill yarding or sideblocking, the more expensive slackline cable system is proposed for 13 to 17 percent of the harvest acres. In all the action alternatives, helicopter logging is proposed for 18 to 28 percent of the harvest area. The volume harvested by each system is not proportionate to the individual harvest area because of the reduced removals where partial-cut harvesting is proposed.

Table 3-75. Proposed harvesting acres by logging system

Logging System	Alt 2	Alt 3	Alt 4	Alt 5
Helicopter	82	101	105	115
Running skyline	272	356	179	297
Small slackline	64	72	67	73
Shovel	23	41	31	38
Total	**441**	**570**	**382**	**523**

Source: Project GIS data

Criteria for selection of logging system

The criteria used to select the appropriate logging system for each alternative include the following:

- Operational feasibility
- Economics
- Windthrow hazard (the presence of tree and stand attributes determining windthrow potential)
- Required level of soil protection
- Special habitat considerations (marten and goshawk habitat requirements)
  - Silvicultural prescription
  - Road access

Vegetation Management Direct / Indirect Effects Specific to Alternative 1

Alternative 1 defers all harvesting at this time, which would result in no immediate change in forest composition. This alternative does not serve to move the analysis area toward the desired condition in the short term. However, it does not preclude future harvesting during the planning horizon.

Many stands in the analysis area consist of old-growth timber. These stands typically have high instances of defect and, in most cases, have reached a point where mortality and losses due to defect approach the average annual growth. Without management, deterioration of mature trees within these stands would continue the process of gap phase replacement, which is characteristic of natural stands in Southeast Alaska. Whole stand replacement events may occur during severe windstorms. However, in most cases, gaps created by smaller events, including single-tree replacement, would be colonized by younger trees that would eventually replace the overstory trees. The overall stand structure, in most cases, would remain similar to the present stand structure. This alternative would result in no change to current forest health conditions. Dwarf mistletoe and decay would continue to affect these stands.

The analysis area contains approximately 7,844 acres of second-growth stands that originated from harvesting in the 1920s through the present. Most second-growth stands are in the stem exclusion development phase and are typically very dense with little or no understory vegetation except where canopy gaps exist.

In the long term, these stands would continue in this phase for a period of up to 100 years or more during which time mortality would continue primarily in intermediate and suppressed crown classes. Long-term monitoring data in Southeast Alaska is limited, but it is expected that commercial thinning would decrease the time that a stand remains in the stem exclusion phase, by accelerating the rate at which density in overstocked stands is reduced (Oliver, 1996). Some dominant and co-dominant trees would also die during this time leaving fewer larger trees to occupy the site. During this period understory vegetation would gradually reappear as natural holes develop and crowns separate, allowing more light to reach the forest floor.

Once stands have opened sufficiently, tree seedlings begin to establish. During this understory reinitiation phase, stands begin to develop a more complex structure. The range in

tree size increases as young trees begin to occupy portions of the stand. Snags and downed woody material develop as trees die. Eventually this development leads to the old-growth development phase, which is characterized by a complex structure in terms of canopy layers, woody biomass, and understory vegetation.

Table 3-76 displays the acreages harvested and regenerated by decade, plus the remaining POG on suitable timber lands. Each group represents a manageable age class. This alternative does not add a new class, which would contribute to the desired condition of a balanced mix of age classes.

Table 3-76. Acres harvested and regenerated by decade and age class[a]

Decade	Suitable Acres	Current Age (years)	Percent of Suitable Land
Old Growth	3,736	200+	40
1920s	2	80	0
1930s	0	70	0
1940s	427	60	5
1950s	0	50	0
1960s	1,742	40	19
1970s	1,786	30	20
1980s	1,156	20	13
1990s	111	10	1
2000s	69	0	1

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

a Acre values displayed in this table include only those acres currently designated as suitable. Some past harvesting occurred on lands that are no longer considered suitable (beach buffer, for example). Those acres are no longer being managed for timber purposes, and are not included in this table

Vegetation Management Direct / Indirect Effects Common to Alternatives 2, 3, 4 and 5

Regeneration Harvesting

All units proposed for regeneration harvesting (CCR and STS) are expected to meet the stocking requirements within five years as required by National Forest Management Act (NFMA) regulations (36 CFR 219.27(c)). Stocking surveys would be completed after the third growing season following harvest. Natural regeneration is expected to be sufficient to meet the stocking requirements. This is based on years of regeneration survey experience on the Tongass (Forest Plan Appendix G). Experience with these stand types permits scheduling of walk-through examinations, rather than formal, systematic sampling. However, in some units inter-planting may be desirable at a later time to improve species composition

Table 3-77. Acres of proposed regeneration harvesting by alternative

Harvesting Method	Alt 2	Alt 3	Alt 4	Alt 5
Two-aged Management (CCR)	362	491	284	444
Uneven-aged Management (STS)	79	79	98	79
Total Regeneration Harvesting	**441**	**570**	**382**	**523**

Source: Project GIS data

Stand Development

Harvesting systems that replace whole stands ("clearcuts") or whole portions of stands, such as clearcuts with reserves, result in the establishment of new age classes over the landscape. This happens either through natural or artificial regeneration. Resulting stands develop through distinct seral stages from regenerated stand to old growth. Clearcutting tends to favor the establishment of spruce and cedars, especially where mineral soil is exposed. As the stand develops, the proportion of hemlock tends to increase because it is more shade tolerant than spruce or cedar. Thinning can produce and maintain a higher proportion of spruce and cedar through the development of the stand.

Clearcuts reduce forest health concerns by eliminating dwarf mistletoe and decay in the harvested parts of the units. Parts of units that are deferred for wildlife habitat, or for other resource concerns, would continue to experience the negative effects of dwarf mistletoe and decay.

Table 3-78 displays the acres moderately infected by dwarf mistletoe by harvesting method. The STS prescription would result in slight increases in dwarf mistletoe in the long term.

Table 3-78. Acres moderately infected by dwarf mistletoe by prescription and by alternative

Harvesting Method	Alt 2	Alt 3	Alt 4	Alt 5
Clearcut w/Reserves (CCR)	165	185	112	150
Single-Tree Selection (STS)	54	54	54	54

Source: Appendix G

Units identified as having a high degree of stem decay are all treated with CCR prescriptions, in all alternatives. However, Alternative 4 treats slightly less acres of stem decay than the other action alternatives (4 acres less).

Along with conifer regeneration, shrubs and herbaceous plants rapidly colonize the site after clearcutting. However, their numbers decrease as conifers dominate the site. Eventually, shrubs and herbaceous species may be nearly absent as the forest canopy closes during the stem exclusion phase. Later stages of development (old growth) are characterized by the reinitiation of shrubs and herbaceous species as individual trees or groups of trees die or are harvested, creating openings that allow light to penetrate the forest canopy.

In Southeast Alaska, without thinning, the stem exclusion phase can last for over 100 years. Precommercial thinning second-growth stands on the island is an on-going activity, covered by previous NEPA analysis. Two thinnings are considered a normal practice in Southeast

Alaska, with an early thinning at about 25 years to control stem density and species composition ("pre-commercial" thinning). Stand growth simulation models for second growth on nearby Kosciusko Island (URS 2002b) indicate that a second thinning ("commercial" thinning) should begin around 65 years to maintain a high volume production rate. Stands harvested in the 1940s (about 712 acres) would reach this average age by 2010. Therefore, commercial thinning was not considered as part of the project because stands are not at the proper age and size, and the economics of commercial thinning on the island would be poor

Partial-harvesting systems, such as STS, retain significant portions of existing stands. In general, less area is disturbed and more shade is maintained with STS treatments than with CCR treatments. Therefore, shade-tolerant species such as hemlock tend to be favored over spruce and cedar. Selection harvesting in old-growth stands assumes that an on-going series of entries would occur to maintain a constant high canopy at less than full stocking. Within a stand, this creates several distinct age classes composed of trees of various sizes and conditions, growing at widely different rates. The objective of STS is the development of a young cohort in addition to the removal of surplus trees from the various diameter classes. Each entry is a regeneration harvesting of a designated portion of the stand and there is no beginning and ending as there is in even-aged and two-aged systems.

Partial harvesting tends to result in less fluctuation in the amount and types of other vegetation that occupy the site. However, if regeneration fails to colonize either new openings created through natural events or harvesting, brush species would increase and may dominate the site for long periods of time. The number of STS harvest acres proposed for Alternatives 2 through 5 is 79, 79, 98, and 79, respectively.

Stand Size Class Distribution

Table 3-79 illustrates the stand size-class distribution by decade. Comparing this with Table 3-76 shows that this project would initiate a new age class of stands. While the alternatives range from 382 acres in Alternative 4 to 570 in Alternative 3, each alternative adds a new age class and adds to the mix of age classes on the island, which is an objective in timber management LUDs. Table 3-79 uses the average of acres in action alternatives to illustrate this point, but does not represent a specific alternative. Comparison of acres accomplished by each alternative is displayed below in the individual alternative discussions. Notice that in order to create about 479 acres in a new age class, an equivalent acreage of old growth was reduced.

Table 3-79. Acres harvested and regenerated by decade, and age class, including the average acreage for action alternatives shown in decade "2000s", age zero

Decade	Suitable Acres	Current Age (years)	Percent of Suitable Land
Old Growth	3,277	200+	36
1920s	2	80	0
1930s	0	70	0
1940s	427	60	5
1950s	0	50	0
1960s	1,742	40	19
1970s	1,786	30	20
1980s	1,156	20	13
1990s	111	10	1
2000s	548	0	6

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database

Vegetation Management Direct Indirect Effects Specific to Alternative 2

Alternative 2 ranks third among the action alternatives in terms of area treated as well as the proportion of that area for which CCR is proposed. Clearcuts with reserves make up approximately 82 percent of the total treated area and STS constitutes about 18 percent.

This alternative is intermediate in terms of area converted to young growth, two-age stands. The need for artificial regeneration would likely be less under this alternative than under Alternatives 3 and 5, but greater than under Alternative 4. Likewise, growth over a rotation should be intermediate compared to the other action alternatives because of the mix of silvicultural prescriptions.

Alternative 2 would result in the third greatest area of two-age stands as a proportion of the treated area. Species diversity over the landscape is expected to be relatively high due to aggressive colonization by spruce and manipulation of the cedar component after clearcutting. Future intermediate treatments (thinning) can help managers increase species diversity over a rotation.

This alternative also ranks third in impact in terms of distribution of understory vegetation across the landscape. A vigorous increase of shrubs and herbaceous vegetation would occur in CCR areas, followed by an extended period during which this vegetation would decrease until canopies were opened up through thinning, when understory vegetation would again increase. In stands harvested with STS, understory vegetation is expected to remain in a condition similar to that of the pre-harvested stand.

Vegetation Management Direct Indirect Effects Specific to Alternative 3

Alternative 3 includes the most area treated as well as the most area where CCR is prescribed. CCR makes up approximately 86 percent of the total treated area and STS constitutes about 14 percent.

This alternative would result in the most acres converted to young-growth, two-age stands using CCR prescriptions. Needs for artificial regeneration are expected to be minimal, but more would likely be needed to meet the stocking requirements or influence species composition as compared to the other action alternatives. Growth over a rotation should be maximized because this alternative converts the most acres of slow growing old-growth stands to vigorous second growth.

Alternative 3 would result in the greatest proportion of treated area in stands with two age classes. Species diversity over the landscape is expected to be relatively high due to aggressive colonization by spruce and manipulation of the cedar component after clearcutting. Future intermediate treatments (thinning) could help managers increase species diversity over a rotation.

This alternative would likely have the greatest impact on understory vegetation. Initial establishment after clearcutting would result in short-term increases of shrub and herbaceous species. However, for a significant portion of the rotation of these stands, there would be a decrease in the amount of understory vegetation. All units where CCR is prescribed would contain areas where existing stand structure is preserved to meet marten and goshawk standards and guidelines. These areas would provide shrub and herbaceous vegetation over the landscape as well as retain some interior forest habitat.

In relative terms, windthrow and wind damage to residual stands would likely be least under this alternative as compared to the other action alternatives. This is because the proportion of the treated area proposed for STS harvesting is lower, and the proportion proposed for CCR is higher.

Vegetation Management Direct / Indirect Effects Specific to Alternative 4

Alternative 4 includes the least number of acres, both in terms of gross area and treated area. As a percentage of treated acres, CCR is less under this alternative than under the other three action alternatives and makes up approximately 74 percent of the total treated area while STS constitutes about 26 percent.

Fewer acres would be converted to young-growth, two-age stands in this alternative than any of the other action alternatives. Needs for artificial regeneration would be relatively low. Although STS stands would contain young-growth components, the overall growth over the series of planned harvests (comparable with an even-aged rotation) would probably be lower than that under the other action alternatives, because older, slower-growing, or stagnant trees would dominate a higher percentage of harvested stands.

Alternative 4 would result in the greatest proportion of treated area in stands with multiple age classes. Although there would continue to be a diversity of species in most of these stands, species composition would tend to shift toward hemlock over time in old-growth stands that have been harvested using STS. This would likely occur to the greatest extent under this alternative.

It is expected that STS harvesting of old growth would retain an understory vegetation component similar to that under the no action alternative. Vegetation in clearcut patches would develop through the previously described process. Over the landscape, understory vegetation would be least affected by this alternative.

Windthrow and wind damage to residual stands would likely be more significant under this alternative than under the other action alternatives. This is because more selection harvesting is proposed as a proportion of treated area. However, the individual units were evaluated for windthrow risk and the silvicultural prescriptions were designed to produce acceptable levels of wind damage.

Vegetation Management Direct / Indirect Effects Specific to Alternative 5

Alternative 5 ranks second among action alternatives in terms of total area treated. Alternative 5 also ranks second in the amount of CCR prescribed, approximately 85 percent of the total treated are. STS would treat about 15 percent of the total area, similar to Alternatives 2 and 3, and less than Alternative 4.

This alternative would result in the second most acres converted to young-growth, two-age stands using CCR prescriptions. Needs for artificial regeneration are expected to be minimal but more would likely be needed to meet the stocking requirements or influence species composition as compared to the other action alternatives.

Alternative 5 would result in the second greatest proportion of treated area in stands with two age classes. Species diversity over the landscape is expected to be relatively high due to aggressive colonization by spruce and manipulation of the cedar component after clearcutting. Future intermediate treatments (thinning) could help managers increase species diversity over a rotation.

This alternative would likely have the second greatest impact on understory vegetation. Initial establishment after clearcutting would result in short-term increases of shrub and herbaceous species. However, for a significant portion of the rotation of these stands, there would be a decrease in the amount of understory vegetation. All units where CCR is prescribed would contain areas where existing stand structure is preserved to meet marten and goshawk standards and guidelines. These areas would provide shrub and herbaceous vegetation over the landscape, as well as retaining some interior forest habitat.

In relative terms, windthrow and wind damage to residual stands would likely be second best under this alternative as compared to the other action alternatives. This is because the proportion of the treated area proposed for STS harvesting is lower, and the proportion proposed for CCR is higher.

Vegetation Management Summary

Table 3-80. Acres affected by each action alternative

	Alt 2	Alt 3	Alt 4	Alt 5
CCR acres	362	491	284	444
% of Area in CCR	82%	86%	74%	85%
STS acres	79	79	98	79
% of Area in STS	18%	14%	26%	15%
Ratio of CCR/STS	4.7	6.3	2.8	5.7
Acres converted to young growth	362	491	283	444
Total Acres treated	441	570	382	523

Source: Project GIS database

Vegetation Management Cumulative Effects

The cumulative effects area for silviculture coincides with the analysis area consisting of National Forest System lands on Tuxekan Island. This represents a manageable geographic area within which past, ongoing, and future timber management activities can be considered together reasonably. This cumulative effects discussion includes timber activities that took place on the National Forest System lands on the island beginning in the 1920s, through on-going activities (thinning), and foreseeable future actions affecting forest stands. National Forest System lands on Tuxekan Island total about 16,890 acres. All action alternatives create the same cumulative positive effects. They only differ in the number of acres harvested and regenerated to new, young stands. Alternative 2 adds 362 acres of new age class stands; Alternative 3, 491 acres; Alternative 4, 284 acres; and Alternative 5, 444 acres.

Past Timber management

Timber harvesting on Tuxekan Island began in 1920, and, since that time, approximately 7,844 acres of old-growth forest has been harvested and regenerated in the analysis area. Past harvesting practices were generally not concerned with windthrow or maintaining the cedar composition of regenerated stands. Spruce and hemlock were the desired species for pulp and sawmills. The relatively large clearcut units have less edge than smaller units have and blowdown was often salvaged without delay when it occurred. No areas were prescribed for uneven-aged management. Timber harvesting peaked in the 1960s and 1970s, declined during the 1980s, and continued at very low levels through the 1990s. Harvesting prior to the mid-1940s was focused on areas accessible from the beach. Harvesting from the mid-1940s to the late 1970s was focused on the northern and central part of the island. Harvesting from the late 1970s through the early 1990s was mostly on the southern part of the island. Harvesting to date has generally been by even-aged clearcutting of old growth stands. Past harvesting plus those proposed with action alternatives for the project would increase the number of acres in a managed condition, and add a new age class so that timber production objectives are available through a range of age and size classes. This is a positive cumulative effect of the project. Table 3-76and Table 3-79 in the preceding discussion illustrate the degree of past harvesting.

There have been approximately 2,145 acres of precommercial thinning done in the analysis area, from the 1980s and 1990s. This thinning, completed without product recovery, was primarily aimed at reducing stem density for more vigorous diameter growth on remaining trees, and favoring spruce and cedars at the expense hemlocks. Species composition of future stands that includes representation of all major species provides a wider array of future management options than do stands with a high proportion of low-value hemlock. Growth, value, and management flexibility are greater in stands that have been actively managed in this way than in stands that develop without management. These past thinnings represent an investment in timber management for increased yield and improved forest health conditions. These have been positive cumulative effects because they improved growth and yield over a range of stand age classes as well as extending forage availability for wildlife by postponing the stem exclusion stand development stage.

Present activities

Projects are currently being completed to thin 1,291 acres of second growth. Ten percent of the thinning is targeted to improve wildlife habitat and one percent to improve riparian

habitat. This thinning project is currently active, and expected to continue over the next few years. Thinning for timber production involves the same principles as have been applied in the past on the island. Precommercial thinning, where no products are recovered in conjunction with the thinning, is designed to promote faster diameter growth on remaining trees, and to adjust species composition in favor of spruce and cedars over western hemlock while extending forage availability for wildlife. This practice advances many of the goals and objectives of the Forest Plan timber management LUDs, and in combination with past harvesting and thinnings, represents a positive cumulative effect over time.

Future Activities

Beyond this Tuxekan Timber Sale project and the on-going thinning project, there are no specific plans in effect for future timber entries on the island. However, it is reasonable to assume, given current direction and emphasis on timber harvesting and timber production that in the long-term there could be additional harvesting and thinning. Of the 7,844 acres harvested and regenerated in the past, 2,145 acres have been thinned, and 1,291 are in progress, which leaves about 3,992 acres of second growth that could be thinned in the future (some of these acres are no longer in development LUDs, but they could be thinned to meet other resource objectives). This Tuxekan Island project could add from 382 acres to 491 acres to the acreage that could be thinned in the future. It is further reasonable to assume that this type of thinning would be conducted using similar techniques as in the past (this work is done by hand, with chainsaws, and individual trees are selected for retention or removal based on prescribed protocols). It is also reasonable to assume, again given current direction, that commercial thinning and old-growth harvesting programs would continue. Commercial thinning is expected to commence when stands reach 60-70 years. Commercial thinning is done in stands where most trees have reached sawlog size. Product recovery is a byproduct of this second thinning, where the primary purpose is to maintain stand and individual tree growth, and to “weed out” any diseases that could affect stand health.

Opportunities would exist in the future to diversify stand age classes further, by continuing to harvest old growth and by beginning the commercial thinning program. Table 3-81 and Table 3-82 represent how future harvesting might distribute age classes further. These two tables are hypothetical, and are presented only to show that past regeneration harvesting, combined with harvesting proposed with this project, and combined with possible future harvesting can diversify age classes in the suitable timberlands on the island, so that long-term goals for sustained production are not precluded. Notice in Table 3-82 that by Decade 2020, over 400 acres harvested initially in the 1940s would be ready for commercial thinning, and can be managed to further diversify size class or structure. In the same decade, over 600 acres of old growth on suitable timber lands could be harvested and those sites regenerated. In subsequent decades harvesting could be accomplished in a mix of old growth and second-growth stands. If management in the future continues along these lines, a positive cumulative effect would result. It maintains an on-going program of forest management (harvest, precommercial thinning, commercial thinning, and final harvest of second growth stands) aimed at long-term production of forest products.

Table 3-81. Hypothetical future age class distribution on suitable NFS timberlands in decade 2010

Decade	Suitable Acres Harvested	Age (years)	Percent of Suitable Land
Old Growth	2622	210+	29
1920s	2	90	0
1930s	0	80	0
1940s	427	70	5
1950s	0	60	0
1960s	1742	50	19
1970s	1786	40	20
1980s	1156	30	13
1990s	111	20	1
2000s	548	10	6
2010s	655	0	7

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

Table 3-82. Hypothetical future age class distribution on suitable NFS timberlands in decade 2020

Decade	Suitable Acres	Age (years)	Percent of Suitable Land
Old Growth	1967	210+	22
1920s	2	100	0
1930s	0	90	0
1940s	427	80	5
1950s	0	70	0
1960s	1742	60	19
1970s	1786	50	20
1980s	1156	40	13
1990s	111	30	1
2000s	548	20	6
2010s	655	10	7
2020s	655	0	7

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

Botany

Botany Affected Environment

Alaska has no threatened and one endangered plant species, *Polystichum aleuticum*. The only known occurrence of *P. aleuticum* is on Adak Island. No federally listed threatened or endangered species would be affected by this project.

There are 19 plant species listed as sensitive in Region 10. Nine of these species are known or suspected to occur within the Thorne Bay Ranger District (USFS 2005). Of these nine species, five sensitive plant species could potentially could in or near the proposed project area (Table 3-83).

Table 3-83. Forest Service sensitive plant species known or suspected to occur within the Tuxekan Island Timber Sale Project.

Plant Species	Habitat
Davy mannagrass *(Glyceria leptostachya)*	Streamsides, lake margins, marshy areas, shallow water
Wright's filmy fern *(Hymenophyllum wrightii)*	Forest edge, wet forest
Loose-flowered bluegrass *(Poa laxiflora)*	Upper beach meadows, open forest, wet meadows
Unalaska mist-maid *(Romanzoffia unalaschensis)*	Forest edge, streamsides, rock outcrops
Queen Charlotte butterweed *(Senecio moresbiensis)*	Heath, dry meadows, wet meadows (alpine and subalpine)

Source: AKNP, 2005

Each of the units chosen for survey was examined for sensitive and rare plants via ground searches using an intuitive meander, which focused on the more open and wet habitats within these stands. Twelve proposed units in the Tuxekan Timber Sale project (35 percent) have been surveyed (8 units in 2000, and 4 units in 1996). Nineteen additional units were also surveyed (yet dropped from project) in previous proposed unit pools. These units were scattered across the island and represent a relatively accurate description of habitat types and species occurrences throughout the entire project area. Because previous surveys were floristic and comprehensive in nature and no newly listed sensitive species are expected in the project area, no additional surveys were deemed necessary. No currently listed sensitive plant species were detected during the field surveys. Two rare plant species, *Platanthera orbiculata* (Rein-orchid) and *Ranunculus orthorynchus* var. *alaschensis* (Strait-beak butter cup) are known to occur within the project area, however, not located within proposed units or along roads accessing units. The biological evaluation was updated in 2005 to meet current forest standards. Biological evaluations, resource reports and Addendum to Biological Evaluation can be found in the project file.

Botany Mitigation Measures

Mitigation is necessary to lower the overall risk of affecting populations. This can be achieved by attempting to avoid areas of known sensitive plants or their habitats and the use of buffers to protect plants and habitats. If sensitive plants are identified during project implementation the district ecologist will be notified and impacts and protective measures will be implemented on a case by case basis.

Botany Direct / Indirect Effects

Botany Direct / Indirect Effects Specific to Alternative 1 – No Action

No ground disturbing activities would occur; however, existing and ongoing processes within the project, recreation, and many other uses will continue. The no action alternative would have no adverse impact direct, indirect or cumulative effect on sensitive species.

Botany Direct / Indirect Effects Common to Alternatives 2, 3, 4 and 5

Direct and indirect impacts to sensitive and rare plants could occur from road building and harvest activities. Additional impacts could include changes in light regime, hydrology, soil conditions, edge effects and changes in other site factors which may be detrimental to sensitive and rare plant populations ability to reproduce, disperse, or remain viable. No sensitive plant species are known within the project area. Sensitive and rare plant surveys indicate the two known rare plant occurences are not located in proposed project units or where road building activities are planned (although it is possible some populations may have been missed). **Therefore, with project mitigation measures, project activities proposed in alternatives 2, 3, 4, and 5 may impact individuals or habitat but would not likely contribute to a trend towards Federal listing or loss of viability to the populations or species.**

Botany Cumulative Effects

The cumulative effects analysis area for sensitive species comprises the project area because project units are scattered across the entire island. The timeframe for the analysis of these effects is the past 85 years and the next ten years (1920-2015). These spatial and temporal boundaries were chosen because past projects included road building and harvest activities that could have impacted sensitive plant habitats.

Since 1920 approximately 7,844 acres of old growth forest has been harvested in the project area. This harvesting peaked in the 1960s and 70s, declined during the 1980s and continued at very low levels through the 1990s. Harvest areas were focused on areas accessible from the beach (1940s), northern and central island (1940s-1970s), and the southern part of the island (1990s). For complete description of historical timber harvest on the island see (Cumulative Effect Map, figure 1-2). It is expected that some of these activities could have impacted rare and sensitive plants and their habitats, however, data is lacking as to specific occurrences and previous habitat acerages. In the past 15 years, more recent harvesting techniques intended to promote regeneration, to maintain structural diversity, to protect riparian habitats in addition to providing habitat for wildlife have been implemented. It is possible that these harvesting activities could have provided more protection for sensitive and rare plant habitats.

No sensitive or rare plant occurrences or habitats are known from previous projects conducted in the project area. There are no known future projects planned in the project area on State or Forest lands.

Botany Cumulative Effects Specific to Alternative 1 – No Action

Because there are no direct or indirect effects to sensitive and rare plant species, no cumulative effects are expected.

Botany Cumulative Effects Common to Alternatives 2, 3, 4 and 5

Since no impacts to sensitive plants or habitats were identified from past projects, no future projects are planned, and the proposed project may impact individuals or habitat but would not likely contribute to a trend towards Federal listing or loss of viability to populations and mitigation measures are expected to protect most unknown occurrences of sensitive plants during project implementation, no cumulative effects are expected.

Wildlife

Threatened and Endangered Species

Several threatened and endangered species occur on the Tongass. However, none are known to occur in the Tuxekan project area. Two federally listed marine mammals occur off the coast of Tuxekan Island; the humpback whale and the Steller sea lion.

Potential effects on federally threatened or endangered marine mammals are discussed in the following subsections. The National Marine Fisheries Service (NMFS) was consulted per Section 7 of the Endangered Species Act (ESA) regarding listed species in the project area. A biological assessment for the Tuxekan project area has been completed for these species and is summarized below (URS 2001b). Consultation for this project was conducted with Ed Grossman, United States Fish and Wildlife Service (USFWS) on January 17, 2001. No effect determinations were documented for this project. Forest-wide biological assessments for the humpback whale and the Steller sea lion prepared by the Forest Service and submitted to NMFS are included in the Forest Plan FEIS (USDA FS 1997b). Kittlitz's murrelet, a candidate species, is found in more northern glacially-affected habitats, such as Glacier Bay and Tracy Arm and is not considered here.

TE Species Accounts

Humpback Whale Affected Environment

The humpback whale (*Megaptera novaeangliae*) is listed as endangered under the ESA and considered a depleted species under the Marine Mammal Protection Act. Humpback whales are found in coastal areas or near oceanic islands and appear to occur primarily in nearshore waters, especially the highly productive fjords of Southeast Alaska and Prince William Sound (Calkins 1986). Humpbacks remain in the Gulf of Alaska region through the summer and fall and begin their migration southward in November; however, some humpbacks have been reported to winter in Southeast Alaska waters (Calkins 1986). The USFWS has not designated critical habitat for this species.

Humpback whales are found in the waters bordering the project area, and they occasionally enter coves and harbors. The local distribution of humpbacks appears to correlate with the seasonal abundance of their prey, primarily herring (*Clupea harengus*) and euphausids

(shrimp-like crustaceans). Important feeding areas near the project area for the humpback occur in Davidson Inlet and Sea Otter Sound, to the west of Tuxekan Island.

Humpback Whale Direct / Indirect Effects

No direct effects on humpback whales are expected from implementation of forest management activities under any of the proposed alternatives. Forest Plan Standards and Guidelines for threatened and endangered species provide for the protection and maintenance of whale habitats. All activities would be conducted in a manner consistent with the Marine Mammal Protection Act, the ESA, and the NMFS regulations for approaching whales.

One potential indirect effect on humpback whales relates to the use of Marine Access Facilities (MAFs). The Tuxekan Project plans to use an existing MAF at Nichin Cove located on the eastern shore of the island. The only potential impact involving MAFs would be the accumulation of log debris and bark in the marine environment. Bark accumulation on the ocean bottom can diminish habitat for bottom-dwelling creatures, hamper underwater vegetation used as food, and interfere with rearing sites for marine fish and other organisms. The MAF at Nichin Cove has both a bulkhead and drive-down rock ramp suitable for loading barges. Logs would be transported from harvest units by trucks and loaded onto barges for transport to conversion facilities (mills) on other islands. Barging logs reduces and minimizes bark and debris from entering the marine environment. Some rafting of logs may be necessary during small timber sales to local operators due to the lack of equipment necessary to barge the logs. Because of the small amount of timber available for these sales, the increase in bark accumulation is likely to be minimal. In addition, the MAF is on the east side of the island, while the more important feeding areas are on the west side of the island. The Forest Plan Standards and Guidelines for protection of marine mammal habitat would be adhered to, and the project would have no effect on the humpback whale.

Humpback Whale Cumulative Effects

Because there are no direct or indirect effects on humpback whales or habitat, there are no cumulative effects. The nearest Critical Habitat is Coronation Island, which is over 30 miles to the west of Tuxekan Island.

Steller Sea Lion Affected Environment

The Steller sea lion (*Eumetopias jubata*) is widely distributed over the continental shelf of the eastern Gulf of Alaska and throughout the coastal waters of Southeast Alaska (Calkins 1986). This species was listed as threatened under the ESA in 1990. In 1991, NMFS reclassified the Steller sea lion into two distinct populations: the Eastern and Western stocks, divided by Cape Suckling in the Gulf of Alaska. The Western stock has been declining rapidly and has been reclassified as endangered (Ferrero 2000). The Eastern stock has maintained a stable or growing population since 1982 and has retained the threatened status. Habitat for the Steller sea lion ranges from Hokkaido Island (Japan), through the Kuril Islands, the Sea of Okhotsk, the Aleutian Islands and the Bering Sea, across the Gulf of Alaska, and south along the West Coast as far as central California. The nearest Critical Habitat is Coronation Island, which is over 30 miles to the west of Tuxekan Island. Sea lions use a number of rocky beaches for haul-outs in the Prince of Wales Island area, mostly on the outer islands. The closest known haul-out to the project area is on the south side of Marble Island, which is approximately four miles northwest of Tuxekan Island.

Steller Sea Lion Direct / Indirect Effects

No areas within the project area have been listed by NMFS as critical habitat for the Steller sea lion. Potential indirect effects due to the MAF at Nichin Cove are discussed above. Forest Plan Standards and Guidelines for federally threatened and endangered species provide for the protection and maintenance of sea lion habitats. There would be no facilities, camps, MAFs or other developments within 1 mile of any known haulouts (Forest Plan Standards and Guidelines), as the nearest haulout is over four miles away from the island. All activities would be conducted in a manner consistent with the Marine Mammal Protection Act, the ESA, and NMFS regulations for approaching seals and sea lions. There are no anticipated direct or indirect effects on sea lions due to the implementation of forest management activities under any alternative.

Steller Sea Lion Cumulative Effects

Because there are no direct or indirect effects on Steller sea lions or their habitat, there are no cumulative effects.

Region 10 Sensitive Species (R10SS)

Species listed as sensitive by the Regional Forester that may occur within the project area are the trumpeter swan (*Cygnus buccinator*), the Queen Charlotte (northern) goshawk (*Accipiter gentilis laingi*), the osprey (*Pandion haliaetus*), and the Peale's peregrine falcon (*Falco peregrinus pealei*). No trumpeter swans were observed during winter surveys of all ponds and lakes on Tuxekan Island (URS 2002c). Other information indicates that the Karheen Lakes are wintering habitat for trumpeter swans (Brockmann et al, 2002). No osprey have been recorded on Tuxekan Island (URS 2002c). There are recorded observations of goshawks on Tuxekan.

There is a low potential for effect to ospreys or peregrine falcons. This is due to the lack of, or low number of sightings; no direct effects on potential nesting habitat; and incorporation of Forest Plan direction to mitigate the effects of disturbance if a nest is found. There is also a low potential for effects to trumpeter swans because the only known use of the area occurs during the winter. Activities associated with this project would not occur in the winter, approximately November to mid-April. In addition, there are no harvest units within .5 miles of the Karheen Lakes system. Because of the low potential for effects, the analysis for these species is not included here, but is found in the Wildlife Resource Report located in the planning record.

Goshawks, which are associated with old-growth habitats, would be directly affected by any of the action alternatives. Public comments on the DEIS included comments and concerns about the need for additional surveys, effects from disturbance, effects of additional loss of habitat, effects of modification of the CCR prescription and location of proposed roads in reserve/deferred areas. Effects on goshawks are discussed in detail here. Implementation of any of the alternatives may affect individual goshawks through habitat alteration and disturbance, but is not likely to affect population viability.

Effects analysis areas used were the Analysis Area (NFS lands on Tuxekan) for direct and indirect effects, and the Project Area (includes all lands on Tuxekan) for cumulative effects.

The Biological Evaluation with species determinations is found in the project record (supplemented on 8/24/05). This analysis has been updated to incorporate all new available information.

Trumpeter Swan Mitigation

- Avoid disturbance to trumpeter swans, particularly during nesting, brood-rearing and winter periods, to prevent abandonment of nests. As a general guideline, limit development within 0.5 miles of wetlands used by nesting, brood-rearing, and wintering trumpeter swans.

Sensitive Species Assessments

Queen Charlotte Goshawk Affected Environment

The Queen Charlotte goshawk is recognized as a distinct subspecies of northern goshawk found only in the coastal areas of British Columbia and Southeast Alaska. Concern exists over the viability of the goshawk population in Southeast Alaska as a result of reductions in the amount of this species' preferred habitat—mature and old-growth forests—from timber harvesting (USDA FS 1997a). In 1994, the USFWS received a petition to list the Queen Charlotte goshawk under the ESA. The USFWS decided not to list the goshawk at that time, and again in 1997, largely based on protective measures included in the Forest Plan. The USFWS is currently updating the 1997 status review to determine if Vancouver Island B.C. is a significant portion of the range and if so, whether the bird is endangered or threatened under the ESA (USFWS 2005).

Goshawks make extensive use of productive old-growth forests in Southeast Alaska for foraging and nesting. Landscape factors such as slope and elevation along with beaches, riparian zones, and estuaries are important for the suitability of goshawk habitat. Riparian zones ranked as the most important landscape component used by radio-collared goshawks (Iverson et al. 1996). Beach, estuary, and riparian habitats generally support greater prey diversity and net prey productivity, features that are important for the quality of goshawk habitat (USDA FS 1998). Approximately 419 acres or 21 percent of the total riparian management area was harvested prior to 1990. In addition, there have been 1,730 acres of beach/estuary buffer harvested prior to 1990.

Goshawks in Southeast Alaska use a variety of prey, including Steller's jay, grouse, varied thrush, woodpeckers, sharp - shinned hawks, and others (Iverson et al. 1996). Most of these prey species use forested habitats, but one uses primarily beach fringe habitat, that may or may not be forested (northwestern crow). Diet varies by time of year, as several of the prey species are migratory. While not listed in Iverson et al. (1996), one researcher (W. Smith, Research Wildlife Biologist, pers. comm.) has suggested that there is information that flying squirrels may also be a prey species for goshawks (also Smith et al, 2004 and Titus et al, 1994).

Studies in Southeast Alaska have found that the median size of female use areas (9,469 acres) were only slightly smaller than those of males (11,425 acres) during the breeding season (Iverson et al. 1996). The entire island (all ownership included) is only 17,730 acres, so at most it may be large enough for only one or two breeding pairs, assuming little overlap between individual female use areas.

Intensive goshawk surveys were conducted in 2000 at 36 stations in portions of the Tuxekan analysis area, in accordance with the latest Forest Service protocols. (See the Wildlife Resource Report [URS 2002c] in the project planning record for details regarding the survey methods and areas covered and the data forms). No goshawk sightings or calls were recorded during the April 2000 survey. In April of 2005, there were two sightings of a single goshawk in the vicinity of the MAF. Follow-up surveys were done in August of 2005 and no nests or nest stands were found. Additional sightings during the summer of 2005 have identified the need for additional surveys in several units; on the north end of the island, units in the vicinity of the MAF and Tuxekan Narrows and the area where a goshawk responded to a begging call during surveys (as shown on unit cards).

Currently, the analysis area (NFS lands on Tuxekan) includes 5,534 acres of goshawk habitat (defined as high volume class strata on slopes <60 percent, and below 1,000 in elevation in TPIT 1998). This is approximately 64 percent of the productive old-growth in the analysis area, or 33 percent of the project area (Table 3-85). Another 44 percent of the analysis area is in second growth forest.

Coarse-structured (multi-aged, large trees) low elevation forest is important for several wildlife species including deer, goshawk, forest songbirds, and cavity nesters. Timber volume classes 6 and 7 (from the GIS cover existveg) are believed to be an adequate predictor of those types of stands (Caouette et al. 2000). The analysis area contains a total of 5,048 acres of volume class 6 and 7 stands.

Goshawk Mitigations

- Dispersion of retained forest structure in Value Comparison Units (VCUs) in high risk provinces where greater than 33 percent of the original (pre 1954) Productive Old Growth (POG) has been harvested. The goshawk and marten standards and guidelines (Forest Plan 4-91, 4-119) are met in the CCR units as trees and canopy to be retained are clumped in reserve areas to ensure that adequate canopy cover will be left after implementation (see discussion in silviculture section). Single Tree Selection (STS) prescriptions meet the guidelines as less than 30 percent of the unit volume or 50 percent of the existing canopy would be designated for harvest.
- The Forest Plan includes standards and guidelines that call for preserving nesting habitat around all confirmed and probable goshawk nests whether or not they are currently occupied. An area of not less than 100 acres of POG (if it exists) will be maintained around the nests tree or probable nest site. It also permits no continuous disturbance likely to result in nest abandonment within the surrounding 600 feet from March 15 to August 15.
- Based on goshawk observations in the area during the summer of 2005, additional surveys to determine occupancy/nesting will be done prior to project activities in those units within the vicinity of the sightings (as identified on Unit Cards).

Queen Charlotte Goshawk Direct / Indirect Effects

The old-growth reserve strategy of the Forest Plan was designed to meet the habitat needs of old-growth associated species, including the Queen Charlotte Goshawk. Generally, Alternative 2, 4 and 5 maintain the best system of small OGRs. Part of the criteria used to map the Interagency small OGRs was to incorporate the best goshawk habitat. See the

Biodiversity section for more information on the small OGRs. Table 3-86 shows the acres of coarse-structured (volume class 6 and 7) forest in the small OGRs, for each alternative. Alternative 3 doubles the acreage of coarse-structured stands protected in small OGRs, while Alternatives 2, 4 and 5 provide more than 4 times the acreage protected in small OGRs. Alternative 1 maintains the current small OGRs, which do not meet Forest Plan direction as described in the Biodiversity section.

Due to the past harvesting on the island, Forest Plan requirements for maintaining an average canopy of 30 percent or greater (in trees that are 16 inches dbh or larger) for goshawks apply to all value comparison units (VCUs) in the project area. Single Tree Selection (STS) prescriptions meet the guidelines because less than 25 percent of the stand basal area would be designated for harvest, leaving about 75 percent of the stands original structure, which would be well above the minimum 30 percent canopy retention requirement.

CCR is the one proposed silvicultural treatment that warrants additional areas to be reserved from harvesting to meet marten and goshawk standards and guidelines. According to the Forest Plan, the retained trees for the marten and goshawk requirements should have a reasonable assurance of windfirmness and should be uniformly distributed throughout the stand, but they may be clumped for operational concerns or ecological opportunities. In the Tuxekan analysis area, retaining essentially unharvested patches or clumps utilizing the CCR silvicultural prescription was often preferable to uniform distribution of reserve trees for the following reasons:

- Many of the originally planned harvest units have a moderate to high risk of windthrow.
- Some of the more common and economical logging systems used in Southeast Alaska may damage or destroy retained trees (especially downhill cable logging systems).
- Worker safety is improved when reserve trees are clumped.
- Some unharvested patches could be incorporated into corridors to improve connectivity of reserve areas.
- Some unharvested patches could increase the size of areas with interior old-growth habitat.
- Using CCR for part of a suitable and available stand that is surrounded by second growth, rather than applying STS to the whole stand, would leave a reserve area to provide refugia for plant species to repopulate the adjacent stands as they mature.

These changes to the CCR prescription are consistent with the new direction that has come out, as a result of the 5-year Forest Plan review (letter dated May 25, 2005). This direction says that for the marten and goshawk guidelines, reserve trees should be clumped rather than scattered to minimize operational difficulties (unless there are other resource concerns such as visuals).

To meet canopy closure and stand structure requirements when retained structure is clumped, TPIT clarification recommends using a 1 to 1 factor for stand retention (USDA FS 1998). For example, assuming an initial canopy closure of 60 percent, the TPIT clarification recommends that for every acre harvested, an equal unharvested number be retained in reserves. Also, within the harvested area, retention of 10 percent or more of the existing structure would be accomplished by leaving suitable trees, or clumps of trees generally greater than 16 inches dbh, as well as non-merchantable trees (less than 9 inches DBH), un-

merchantable trees, (greater than 66 percent defect), safe snags, and large woody debris. The 10 percent retained should be reasonably windfirm, and situated to last well into the next rotation. It should be protected by unit design and layout, or contract provisions, or both. All proposed CCR harvesting units in the Tuxekan Project include at least an equal number of acres to be harvested and acres that would be deferred or reserved from harvest, therefore meeting the marten and goshawk requirements using the 1 to 1 factor for stand retention. For several units, deferred or reserved areas are larger than the harvested areas. Table 3-84 shows deferred or reserved acres for CCR units.

Table 3-84. Silvicultural harvesting methods

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres STS	0	79	79	98	79
Acres CCR	0	362	491	284	444
Deferred or reserved in CCR units	0	475	706	463	608

There are a few cases where existing or proposed new roads are located in the reserve or deferred area of a CCR unit. It is recognized that these areas do not contribute to meeting the goshawk guidelines and the acreage lost within the road clearing will be accounted for during unit layout. During field layout, crews will include road clearing acreages along with harvesting unit acreages (in CCR units) in calculating the acres needed for deferral.

Table 3-85 shows the amount of goshawk habitat that would be harvested under each alternative, including both STS and CCR methods. Alternative 3 would have the greatest impact on high-value goshawk habitat (570 acres), whereas Alternative 4 would have the least impact (381 acres). However, implementation of any of the action alternatives would result in a 2 to 4 percent decline in high-value habitat across the analysis area. Reserved/deferred areas are largely composed of high-value goshawk habitat.

Table 3-85. Goshawk habitat in the analysis area (NFS lands only)

Alternative	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres harvested	0	441	570	382	523
Acres remaining	5,534	5,093	4,964	5,153	5,012
Percent of analysis area	33%	30%	29%	31%	30%

Source: high volume class on slopes <60% and <1000 ft elevation

Coarse-structured (multi-aged, large trees) low elevation forest can also be addressed using timber volume classes 6 and 7 (from the GIS cover existveg). The analysis area contains a total of 5,048 acres of volume class 6 and 7 stands. Table 3-86 shows the percent of the analysis area in volume class 6 and 7 after implementation of the alternatives. There would be a two to three percent decrease in VC6 and VCU7 stands as shown below.

Table 3-86. Coarse-structured stands by Alternative in the analysis area (NFS lands)

Alternative	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres VC 6 and 7	5,048	4,712	4,589	4,750	4,635
Percent of analysis area	30%	28%	27%	28%	27%

Source: based on GIS volume class

The Conservation Assessment for goshawks in Southeast Alaska (Iverson et al. 1996) included an analysis of fragmentation and edge effects. They used goshawk telemetry relocation data and data from a GIS database to assess natural and induced edge and effects to goshawk habitat use patterns. They were unable to discern selection for or against edge and interior habitats. Based on this, there will be no further analysis of edge effects for goshawks.

There are no confirmed goshawk nesting sites in the Tuxekan project area. However, goshawks are extremely difficult to locate, and it is possible that the project area includes breeding territories. Activities associated with road work or timber harvesting could cause disturbance to nesting goshawks. Any goshawk nests found during additional follow-up surveys and field reconnaissance or unit layout would be protected from harvesting by implementing Forest Plan Standards and Guidelines for goshawks. These standards and guidelines require the maintenance of an area of no less than 100 acres of productive old-growth (POG) forest (if it exists) generally centered over the nest tree or probable nest site, preferably with a multilayered, closed canopy and providing foraging opportunities for young goshawks. No commercial timber harvesting is permitted, and no continuous disturbance likely to result in nest abandonment is permitted within the surrounding 600 feet from March 15 to August 15. Activity restrictions are removed for active nests that become inactive or are unsuccessful. Any nesting pairs that are not discovered prior to project activities may be affected depending on time of year, type of activity, and distance between the nest and activity.

Goshawks tend to not use the same nest site in subsequent years, so availability of alternate nest sites in the breeding territory is an important habitat feature. The current nest protection measures are “nest based”, and harvest could occur around the nest, reducing the availability of alternate nest sites (in Hanley et al, 2005). However, as discussed in the Biodiversity OGR analysis, the Interagency OGRs were developed to incorporate the best goshawk habitat.

Of the action alternatives, Alternatives 2, 4 and 5 maintain the most habitat for goshawks. This is due to implementation of interagency small OGRs (Alternative 2 incorporates the interagency small OGRs with slight modifications), increased amount of coarse-structured stands protected in the small OGRs, and less harvesting of high-value habitat and volume class 6 and 7 stands, compared to Alternative 3. Implementation of any of the alternatives may affect individuals through habitat alteration and disturbance, but is not likely to affect population viability.

Queen Charlotte Goshawk Cumulative Effects

The cumulative effects analysis area for goshawks is Tuxekan Island (project area). The timeframe incorporated the effects of the past and reasonably foreseeable actions and is

limited to the direct reduction of goshawk habitat. Effects of any future timber harvesting will be addressed as part of the analysis for those projects. There are no reasonably foreseeable future timber sales proposed on Tuxekan, on federal or non-federal lands. The direct and indirect effects analysis already incorporates the effect of past timber harvesting on National Forest System lands. This has been through the application of the goshawk guidelines in areas with greater than 33 percent of the POG harvested, as well as in the development of the interagency small OGR recommendations. Alternatives 4 and 5 fully incorporate these interagency small OGR recommendations. Alternative 2 incorporates it with only a couple of small modifications.

There are approximately 5,867 acres of goshawk habitat in the project area (Tuxekan Island); or about 33 percent of the island is high-value habitat. There would be a 2 to 3 percent decrease in high value habitat in the project area, as shown in Table 3-87.

Table 3-87. Goshawk habitat in project area (all of Tuxekan Island regardless of ownership)

Alternative	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres habitat	5,867	5,426	5,297	5,486	5,345
Percent of project area	33%	31%	30%	31%	30%

Source: high volume class on slopes <60% and <1000 ft elevation

Early seral conifer stands provide low quality foraging habitat for goshawks. They will likely remain poor through the stand initiation and stem exclusion phases of forest succession (Iverson et al, 1996) or at least 100 years. Currently, about 44 percent of the island is in second growth. Implementation of Alternatives 2 and 4 would increase this to 46 percent while the other action alternatives would increase the amount of second growth to 47 percent of the island.

The amount of goshawk habitat has been greatly reduced over the island. Raptors that thrive on forest edge may either compete with, or prey on, goshawks as the island become more fragmented. Though population assessments are not available at the project level, goshawks are believed to be relatively rare, are at the edge of their range and likely declining throughout Southeast Alaska because of habitat loss (Iverson et al, 1996). Adjustment of small OGR boundaries to meet Interagency recommendations (Alternative 2 with slight modifications, and Alternatives 4 and 5) would best contribute towards the Forest Plan goal of maintaining viable goshawk populations across the landscape.

Management Indicator Species (MIS)

MIS are vertebrate or invertebrate species whose response to land management activities can be used to predict the likely response to other species with similar habitat requirements (USDA FS 1997b). The Forest Plan identified 13 MIS for the Tongass. Nine of these species are found in the Tuxekan analysis area; Sitka black-tailed deer, black bear, marten, Alexander Archipelago wolf, hairy woodpecker, river otter, red-breasted sapsucker, Vancouver Canada goose, and bald eagle.

There is a low potential for effect to river otters or Vancouver Canada goose. This is due to the lack of, or low number of sightings; no direct effects on potential habitat; and/or

incorporation of Forest Plan direction to mitigate the effects of disturbance if they are found. Because of the low potential for effects, the analysis for these species is not included here, but is found in the Wildlife Report in the project planning record. Black bear, which do occur on the island, were analyzed. Black bears are considered habitat generalists. The riparian habitats and beach/estuary habitats used by many species, including bears, are protected under Forest Plan Standards and Guidelines. The implementation of an Access Management Plan, will occur under all alternatives. There is no clear difference between alternatives for the bear, and it is not discussed here. See the project planning record for more information on the black bear.

Public comments on the DEIS included comments and concerns about several MIS; specifically wolves, deer and marten. These species, along with others, are discussed in detail below.

Wildlife viability ranks high among land-management issues, and maintaining viable populations of all species is a key requirement. The Forest Plan incorporated the best available information at the time. Since then, several studies were initiated to follow up on key information needs identified during the Forest Plan process. Hanley et al (2005) summarized the major findings in these studies and they have been incorporated where appropriate.

Effects analysis areas used for most species were the Analysis Area (NFS lands on Tuxekan) for direct and indirect effects, and the Project Area (includes all lands on Tuxekan) for cumulative effects. Effects analysis for Sitka black-tailed deer and Alexander Archipelago wolf also looked at WAA 1531.

Assumptions

The Tongass NF reviewed the best available population data for each MIS for the 2002 Tongass Monitoring and Evaluation Report. In most cases, these data did not indicate strong upward or downward trends in populations. With the exception of wolves, all other species were consistent with the expectation of the Forest Plan FEIS; in general species will decline in proportion to loss of habitat capability (USDA FS 2003). As a result, the analyses for most species will focus on changes to habitats.

The assumption used to evaluate effects includes a winter shut-down period. The actual period may vary from year to year, depending on snowfall but for this analysis it may run from November to mid-April. Individual sales could be harvested in two years, but the contract period could allow three to five years.

It is also assumed that the planned work to be done on the existing MAF will not result in an increase in use or increased access to hunters or trappers. The existing MAF already has a ramp that allows small barges that can carry vehicles or ATVs to unload.

Another assumption made for analysis is that units harvested prior to the Forest Plan did not incorporate any snag retention. While there may be some snags left in areas that were inaccessible, or in areas where they were not safety concerns, overall past harvesting units (prior to 1997) are now deficient in snags.

Precommercial thinning is generally done at 15 to 30 years after harvest. Understory vegetation will increase after the precommercial thinning, but after about 20 years it will start to decline due to the overstory stand closing back in. Around 50 to 70 years after the

harvesting the stand will be assessed for the need for commercial thinning. After commercial thinning, the stand would have a more open overstory, and the understory vegetation would increase.

MIS Accounts

Sitka Black-tailed Deer Affected Environment

The Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) was chosen as a MIS because of its importance as a subsistence and game species and its seasonal association with old-growth forest. Sitka black-tailed deer are indigenous to coastal regions of Southeast Alaska and British Columbia. Optimum winter deer habitat especially during deep-snow conditions is low-elevation, high-volume old-growth situated on well drained sites that are characterized by large, irregularly spaced trees and an understory of abundant bunchberry (*Cornus canadensis*), five-leaved bramble (*Rubus pedatus*), and Vaccinium species (Hanley et al. 1989). Although deer in Southeast Alaska are generally considered an old-growth-dependent species (Suring et al. 1992b), this species forages extensively in young growth less than 10 years old, particularly during mild winters (DellaSala et al. 1993), spring, and summer. During the first 10 years after clearing, second-growth forests show a dramatic increase in the production of plants that are the primary food of deer in the winter (Suring et al. 1992b). After approximately 25 years, the created openings begin forming a dense, closed-canopy young forest, resulting in a rapid reduction of nutritious understory forage for deer; therefore, habitat quality declines. An understory begins to develop again as stands reach 120 to 160 years of age (Alaback 1982). The value of these areas as deer habitat continues to increase as the forest matures into old-growth forest.

The winter availability of forage is the most limiting factor on Sitka black-tailed deer. The capability of winter habitat to support Sitka black-tailed deer is a function of forage abundance and quality (Hanley et al. 1989), snow interception qualities of the overstory (Hanley and Rose 1987; Kirchhoff and Schoen 1987), and climate as influenced by aspect, elevation, and maritime conditions (Hanley and Rose 1987). Cleared areas and young second growth greatly exacerbate the impacts of deep-snow winters by providing little snow interception, thus burying the available forage resulting in high deer mortality. Even in unlogged conditions, a deep-snow winter can result in relatively high deer mortality. Deer populations also respond to predation pressure and hunting mortality. Predation by wolves in particular is thought to significantly retard the recovery of the deer herd from mortality resulting from deep-snow winters. Demand for deer by humans may not be met after a deep snow winter.

Because identifying and managing black-tailed deer habitat has been an important issue for many years on the Tongass, studies are still underway to better identify habitat needs. Doerr et al (2005) found that in years with above average snowfall, deer selected south aspects, at less than 153m elevation and within 305 m of saltwater. Of four habitat mapping methods that they evaluated, the method using moderate and high timber volume strata and a wind-disturbance-related aspect had greatest utility in identifying areas used by deer.

In general, deer winter range is a mix of forested and non-forested areas that provide adequate thermal cover and forage for body maintenance for deer during the winter months. The size of available winter range can vary from year to year depending on factors such as snow depth and persistence. No quantitative data on the historic distribution of high-value

deer winter range is available for Tuxekan. The amount of high-value winter range can be estimated by reconstructing the timber volume strata and identifying high-value areas using the Tongass deer model.

ADF&G biologists estimated a relatively low density of deer on the island after site visits in 1997. This low density is probably due to the prevalence of closed-canopy second growth (ADF&G 2000).

The deer habitat capability index (HCI) model developed for the Forest Plan FEIS (USDA FS 1997b) was used to evaluate the potential quality of winter habitat for Sitka black-tailed deer. The model incorporated the following factors in the analysis: (1) snow conditions, (2) physiographic features including aspect and elevation, and (3) vegetation characteristics including volume class of old-growth, second growth (25 to 200 years), and clearcut (0 to 25 years). An analysis of deer winter range resulted in habitat suitability index (HSI) values on National Forest System lands. HSI scores were then grouped into three categories of winter-range quality: high (HSI greater than 0.39), medium (0.15 to 0.38), low (0.01 to 0.14), and unsuitable (0.0). These winter-range quality categories, which are based on area-specific model results, are a way to rank habitat quality in a relative sense. Table 3-88 shows the shows the habitat quality of existing deer winter range on National Forest System lands.

Table 3-88. Deer winter range habitat quality based on HSI

HSI scores	Habitat Quality	Acres in Analysis Area
>.39	High	8,717
0.15 - 0.38	Medium	2,746
0.01 – 0.14	Low	5,415
0	Unsuitable	18

Source: URS 2002

The Tongass deer model was used to identify existing high-value deer winter habitat in the analysis area. Results from the model show current habitat capability to be 1,280 deer (a 40 percent decline since 1954) on NFS lands. When non-NFS lands are included, factoring in current habitat conditions, the current habitat capability is 1,332 deer (see Table 3-90).

Coarse-structured (multi-aged, large trees) low elevation forest is important for several wildlife species including deer, goshawk, forest songbirds, and cavity nesters. Timber volume classes 6 and 7 (from the GIS cover existveg) are believed to be an adequate predictor of those types of stands (Caouette et al. 2000). The analysis area contains a total of 5,048 acres of volume class 6 and 7 stands.

The Sitka black-tailed deer is by far the most important and most “harvested” terrestrial wildlife species for subsistence purposes and sport hunting (USDA FS 1997b). Biologists estimate that 10 percent of a population can be harvested at carrying capacity with the population remaining stable and hunter satisfaction remaining high (Suring et al. 1992b). Harvesting data are collected by the ADF&G and summarized by wildlife analysis area (WAA). The project area falls into ADF&G-designated WAA 1531, which also includes Marble Island and several islands in Sea Otter Sound. ADF&G-documented harvesting of deer from the project area is provided in Table 3-89. The declining harvesting of deer and

other wildlife can be partially attributed to the declining population, including hunters, of Edna Bay on Kosciusko Island and Naukati on Prince of Wales Island. In addition, most of the 7,844 acres of second-growth forest in the Tuxekan analysis area (NFS lands) is currently in the stem exclusion phase of regeneration. As discussed previously, this phase produces less forage for deer and therefore may also contribute to a decline in deer populations.

Table 3-89. Deer harvest by year for WAA 1531

Harvest year	Number reported
1995	35
1996	9
1997	0
1998	20
1999	0
2000	50
2001	39
2002	10
2003	9

Source: ADFG 2003

Sitka Black-Tailed Deer Direct / Indirect Effects

The Tongass deer model was one tool used to evaluate effects to winter habitat for deer. As noted previously, the deer model estimates the capability of habitats to support deer during winter and does not reflect actual populations in the project area. Results of the Tongass deer model are displayed in Table 3-90. In general, higher value habitat drops in quality when harvested and again at stem exclusion stage. In contrast, lower value habitat may increase in value following harvesting because of increased forage, but values drop below pre-harvesting level once stem exclusion occurs (see USDA FS 1997b, pp. 3-365 thru 3-379 and USDA FS 2005 letter from Forest Supervisor for model details, outputs, and revisions (USDA FS 2005f)). Deer habitat capability in the analysis area declined since timber harvesting began in the 1940s. The Tuxekan Project alternatives would add to that decline.

In this effects analysis for black-tailed deer, habitat capability estimates were calculated two different ways. The first uses the project area and includes habitat capability from non-NFS lands. This method should most clearly display the difference between alternatives, as it more clearly focuses on the immediate area affected. The second method was used for the cumulative effects analysis. This method was to run the model over the entire WAA (1531) as done in the Forest Plan, and includes zero habitat capability for non-NFS lands. This method was used in the Forest Plan and estimates the worst-case scenario. This was done to account for the additional habitat decline expected through 2095 due to development over the next 100 years on non-federal lands (Forest Plan App. N). See Table 3-90 (Deer Model Results) for these results.

Model outputs are more useful for comparing relative changes by alternative and do not indicate actual effects to individual animals. In determining effects to deer habitat, the Tongass deer model assesses overlap of proposed treatment units with stand polygons that have been assigned a habitat suitability score. It assumes the entire proposed unit is treated

when in actuality, harvesting occurs within a portion of the units. Because of this assumption the model provides an overestimate of effects. As discussed earlier, habitat suitability scores are based on vegetation structure, snow depth, elevation, and aspect. Other factors that affect the quality of the habitat, which are not included in the deer model, include fragmentation, continuity/connectivity, and proximity to roads (Hershey and Leege 1976, Lyon et al. 1985, Hillis et al. 1991, Edge and Marcum 1991, Lyon and Christensen 1992). There are on-going efforts to update the deer model, including nutrition, deer/wolf and DNA modeling.

Over the short term, deer may avoid some treated stands due to treatment activities and post-treatment slash depth. Indirectly, increased forage production in treated stands should help to maintain deer populations in the short-term, by providing summer forage. Once treated areas reach the stem exclusion stage, and without additional intermediate treatment, they would not function as suitable deer habitat until approximately 100 years post-harvest. After about 120 years, an understory begins to develop again.

As shown in Table 3-90 below, the level of proposed harvesting is not high enough show significant changes between the alternatives using the deer model.

Table 3-90. Deer model results

	1954	2005	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Project Area (Tuxekan) includes habitat capability from non-NFS land							
Deer habitat capability	2,250	1,332	1,295	1,269	1,260	1,272	1,263
Deer/Sq Mi	81	48	47	46	46	46	46
WAA 1531 (assumes 0 habitat capability for non-NFS land)							
Deer habitat capability	3,765	2,246	2,246	2,220	2,211	2,223	2,214
Deer/Sq Mi	67	40	40	40	39	40	39

Note: no reduction for predation

There are approximately 8,717 acres of high-value deer habitat in the analysis area. Alternative 4 would protect the most habitat with the full implementation of the interagency committee’s recommendations for the small OGRs and the deferral of several units located in high-value deer habitat. Units deferred in this alternative include many that are located in existing wildlife corridors between the small OGRs, as previously described. Alternative 4 would affect the least amount of high value habitat, 357 acres, followed by Alternative 2 with 415 acres of harvesting in high-value habitat (Table 3-91). Alternative 3 would have the greatest effect on high value habitat (540 acres). Harvesting would occur in several units located in high- and medium-value deer winter range as well as in the existing wildlife corridors between small OGRs. Deep snow winters are less frequent on the outer islands as elsewhere on the Tongass. However, demand for deer by humans may not be met if a deep snow winter occurs. The relative ranking of alternatives with respect to the effects of a deep snow winter would be the same as described above for removal of high-value deer habitat.

Table 3-91. High-value deer habitat

Alternative	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres HV deer habitat post project	8,717	8,302	8,177	8,360	8,224
Acres harvested	0	415	540	357	493
Percent of analysis area	52	49	48	49	49

Source: URS 2002

Partially offsetting the impacts resulting from the reduction of deer wintering habitat, the harvest units in all alternatives would provide new forage in the clearcut with reserve (CCR) units and in the gaps created in the forest canopy through single tree selection (STS) harvest. This new forage would help to mitigate lack of summer forage in the existing second-growth stands that are in or are entering the stem exclusion stage. These stands are not currently providing winter forage due to the lack of overstory for snow interception. In addition, the proposed harvest units are intentionally more dispersed and relatively smaller in average size (16 to 18 acres) compared to previous harvest units on Tuxekan Island. The existing second-growth units are larger and are situated in groups on the island. The replacement of forage and the dispersal of smaller harvest units should help reduce the impacts to deer over the short-term.

Coarse-structured (multi-aged, large trees) low elevation forest can be addressed using timber volume classes 6 and 7 (from the GIS cover existveg). The analysis area contains a total of 5,048 acres of volume class 6 and 7 stands. Table 3-92 shows the percent of the analysis area (NFS lands on Tuxekan Island) in volume class 6 and 7 after implementation of the alternatives. There would be a 2-3 percent decrease in volume class 6 and 7 stands as shown below.

Table 3-92. Coarse-structured stands by Alternative in the analysis area (NFS lands on Tuxekan)

Alternative	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres VC 6,7	5,048	4,712	4,589	4,750	4,665
Percent of analysis area	30%	28%	27%	28%	28%

Source: GIS volume class

Sitka Black-Tailed Deer Direct / Indirect Effects Specific to Alternative 1

Interagency review found the currently designated small OGRs to be in inconsistent with Forest Plan old-growth reserve criteria (USDA FS 1997; App. K). For additional discussion of old-growth reserves see the biodiversity section. However, no harvesting would occur, and there would be no reduction in habitat capability or high-value habitats.

Sitka Black-Tailed Deer Direct / Indirect Effects Common to Alternatives 2, 3, 4 and 5

Treatments proposed under all action alternatives would result in the reduction of habitat capability in the project area (Table 3-90). Theoretical deer densities, on all lands regardless

of ownership, would exceed the Forest Plan Standard and Guideline of 17 deer per square mile (Forest Plan Clarification Papers 1998) or the recommended 18 deer per square mile (2000 Monitoring and Evaluation Report).

The construction of proposed temporary and NFS roads would have short-term effects (less than 10 years) to deer by increasing the possibility of mortality due to hunting. Current levels of hunting mortality (Table 3-89) are well below 10 percent of the theoretical population (as estimated by the deer model) that can be harvested at carrying capacity with the population remaining stable. Table 3-57. Road densities during and post-project displays the open road densities and total road densities, both during project activities, and after implementation of the Access Management Plan. While new road corridors would improve walk-in access even after being closed, vulnerability to hunters would decrease under all alternatives after implementation of the Access Management Plan.

Edge effects created by new temporary or NFS roads would continue into the future, whether open or closed. The loss of canopy cover would decrease snow interception, limiting movement and forage availability in deep snow winters. There are currently 58.8 miles of road in the analysis area; Alternative 3 that proposes the most new road construction would increase this by 9.6 miles. Because these are narrow, linear features, these effects should be much more limited than the effects of harvest units.

Of the action alternatives, Alternatives 2, 4 and 5 maintain the most winter habitat for deer. This is due to implementation of interagency small OGRs (alternative 2 implements them with minor modifications), increased amount of coarse-structured stands protected in the small OGRs, and less harvesting of high-value habitat and volume class 6 and 7 stands, compared to Alternative 3. Implementation of project activities proposed in all alternatives may adversely impact individuals but are not likely to result in a loss of viability in the Planning Area, not cause a trend toward federal listing.

Implementation of any of the alternatives may affect individuals through habitat alteration and disturbance, but is not likely to affect population viability.

Sitka Black-tailed Deer Cumulative Effects

The cumulative effects analysis areas used for Sitka black-tailed deer are Tuxekan Island (project area) and WAA 1531. The time frame used incorporates the effects of past and reasonably foreseeable timber harvesting and is limited to the direct reduction of deer habitat that is experienced when the harvested stands reach the stem exclusion stage. It is assumed that all planned timber harvesting would occur within the next ten years and that all harvested stands would be in the stem exclusion stage at the year 2054. The deer model results for the year 2054 for the project area and WAA 1531 are shown in Table 3-93 below. Habitat capability still exceeds the requirement of 17 deer per square mile (Forest Plan Clarification Papers 1998) and the recommendation of 18 deer per square mile (2000 Monitoring and Evaluation Report) to support both hunting and wolves.

Table 3-93. Deer model results for 2054 (end of rotation) using zero habitat capability for non-NFS lands

Alternative	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
WAA 1531					
Deer habitat capability	2,078	2,016	1,996	2,023	2,003
Deer/Sq Mi	37	36	36	36	36

Note: No reduction for predation.

There is no reasonably foreseeable future timber harvesting planned on federal or non-federal lands. The only foreseeable future action is timber management in previously harvested stands (pre-commercial thinning). Pre-commercial thinning could improve forage availability during summer and connectivity between stands and across the island over the long-term.

Clearcut stands older than 25 years contribute only marginally to deer habitat capability because of lack of forage. Without intermediate treatments such as precommercial and commercial thinning, these older clearcut stands enter into the stem exclusion phase approximately 26 years after harvesting and maintain those characteristics for 100 years or more. These factors were built into the deer model, so are already incorporated into the results (year 2054). Some replacement summer forage would be produced with commercial thinning second growth stands in the stem exclusion phase that are approximately 65 years old.

American Marten Affected Environment

The American marten was chosen for analysis because it is associated with low-elevation, old-growth forests during the winter (USDA FS 1997b). Cook et al. (2001) looked at the genetics of several species to identify where there were deep genetic divergences. American marten (*Martes americana*) was found to have a deep genetic divergence. There is the coastal lineage and the continental lineage. The continental lineage is more widespread in Southeast Alaska and is the lineage found on the islands around Tuxekan. ADF&G transplanted marten to POW and other islands and it may be reasonable that the marten on Tuxekan would be of this lineage due to its close proximity to Prince of Wales (POW). It has been reported that five marten were trapped from Tuxekan in 1999 and sent to UAF museum for genetic analysis (E. Lance, pers. comm.) but according to communications with J. Cook, genetic analysis has not been done to verify the lineage (J. Cook, Associate Professor UNM, pers. comm.).

Marten are dependent on large snags, downed logs, and undercut banks for den sites. The quantity and quality of winter habitat are the most limiting factors for marten in Southeast Alaska. Recent studies of habitat choice for dens and resting sites revealed that natal dens were in the boles of trees and snags or hard downed logs, and resting sites were beneath the roots of trees and snags. They clearly used the largest diameter trees and snags or stumps available, most of which had evidence of decay and cavities (in Hanley et al, 2005). High value marten habitat is considered to be high-volume forest below 1,500 feet in elevation. Currently, 6,316 acres of the Tuxekan analysis area can be classified as high-value marten

habitat. Martens were observed on Tuxekan Island by several crews working on Tuxekan but no systematic counts or surveys to estimate population densities have been performed.

Population trends are unknown and are difficult to estimate as populations fluctuate naturally, due to changes in prey populations and winter weather conditions. Southeast Alaska trappers are more interested in martens than any other furbearer species (ADF&G 2004). Unit 2 marten harvests are typically high compared to elsewhere in Southeast Alaska. There has been an average harvest of 804 marten per year over a 19-year period in Game Mamagement Unit 2. Low-harvesting years may be associated with low trapper effort due to poor weather conditions and heavy snow rather than to abundance of marten. Trapping season runs from December 1 through February 15, with no limit on numbers taken. ADF&G reports harvests of 6 to 30 marten per year in WAA 1531 from 1995 through 1999 (Turek 2001).

Marten are often harvested and can be relatively easily trapped; their harvesting corresponds closely to the availability of road and beach access (Suring et al. 1992). Marten densities decrease (due to their susceptibility to overtrapping) when road densities exceed 0.2 mile of road per square mile, and potentially decrease by as much as 90 percent when road densities approach 0.6 mile of road per square mile (assuming sustained trapping pressure). Open road density in the analysis area is currently 1.4 mile of road per square mile. Such sensitivity to road densities is typical in areas with substantial trapping pressure, however Tuxekan Island is not considered to have sustained trapping pressure. Tuxekan Island has no direct connection to any community. There have been no official concerns raised by any federal or state agency that this level of mortality (as a result of access) threatens the stability of the marten population in the project area.

Coarse-structured (multi-aged, large trees) low elevation forest is important for several wildlife species including marten, deer, goshawk, forest songbirds, and cavity nesters. Timber volume classes 6 and 7 (from the GIS cover existveg) are believed to be an adequate predictor of those types of stands (Caouette et al. 2000). The project area contains a total of 5,048 acres of volume class 6 and 7 stands.

American Marten Mitigation

- Dispersion of retained forest structure in Value Comparison Units (VCUs) in high risk provinces where greater than 33 percent of the original (pre 1954) Productive Old Growth (POG) has been harvested. The goshawk and marten standards and guidelines (Forest Plan 4-91, 4-119) is met in the CCR units as trees and canopy to be retained are clumped in reserve areas to ensure that adequate canopy cover will be left after implementation to prevent loss from windthrow. In addition to the clumps of reserve trees, at least 10 percent of the original stand structure would be retained in the openings between the clumps. Single Tree Selection (STS) prescriptions meet the guidelines as less than 30 percent of the unit volume or 50 percent of the existing canopy would be designated for harvest. Retained features should include large trees for snag recruitment (8 large trees/acre 20-30 inches dbh), dead or dying trees, large downed material and smaller or younger trees for future stand recruitment.

American Marten Direct and Indirect Effects

The Forest Plan has specific protective standards and guidelines for high-value marten habitat in the higher risk biogeographic provinces (USDA FS 1997a). The Tuxekan analysis area falls within the North Central Prince of Wales Island Province, which is one of the higher risk provinces. Due to the fact that more than 33 percent of the original (pre 1954) productive old-growth (POG) has been harvested in each of the VCUs in the project area, timber harvest units must meet specific Forest Plan Standards and Guidelines for marten.

Standards and guidelines for American marten include: retaining (1) an average of 30 percent canopy closure, (2) an average of at least eight large trees (20- to 30 inch diameter at breast height [DBH] or greater) per acre for future snag recruitment, (3) an average of at least three large decadent trees per acre, and (4) an average of at least three pieces per acre of downed material (logs 20 to 30 inches or greater in diameter and 10 feet long), generally distributed throughout the harvest unit.

Harvest units in all action alternatives were designed to meet marten and goshawk standards and guidelines. One of the two silviculture prescriptions, single tree selection (STS), proposed for the Tuxekan Project meets marten and goshawk requirements by design. STS prescriptions meet the guidelines because less than 25 percent of stand basal area would be designated for harvest, leaving about 75 percent of the stands original structure, which would be well above the minimum 30 percent canopy retention requirement.

Clearcut with reserves is the one proposed silvicultural treatment that warrants additional areas to be reserved from harvesting to meet marten and goshawk standards and guidelines. According to the Forest Plan, the retained trees for the marten and goshawk standards and guidelines should have a reasonable assurance of windfirmness and should be uniformly distributed throughout the stand, but they may be clumped for operational concerns or ecological opportunities. On Tuxekan Island, retaining essentially unharvested patches or clumps utilizing the CCR silvicultural prescription was often preferable to uniform distribution of reserve trees for the following reasons:

- Many of the originally planned harvest units have a moderate to high risk of windthrow.
- Some of the more common and economical logging systems used in Southeast Alaska may damage or destroy retained trees (especially downhill cable logging systems).
- Worker safety is improved when reserve trees are clumped.
- Some unharvested patches could be incorporated into corridors to improve connectivity of reserve areas.
- Some unharvested patches could increase the size of areas with interior old-growth habitat.
- Using CCR for part of a suitable and available stand that is surrounded by second growth, rather than applying STS to the whole stand, would leave a reserve area to provide refugia for plant species to repopulate the adjacent stands as they mature.

These changes to the CCR prescription are consistent with the new direction that has come out, as a result of the 5-year Forest Plan review (letter dated May 25, 2005). This direction says that for the marten and goshawk guidelines, reserve trees should be clumped rather than scattered to minimize operational difficulties (unless there are other resource concerns such as visuals).

To meet canopy closure and stand structure requirements when retained structure is clumped, TPIT clarification recommends using a 1 to 1 factor for stand retention (USDA FS 1998). For example, assuming an initial canopy closure of 60 percent, the TPIT clarification recommends that for every acre harvested, an equal unharvested number be retained in reserves. Also, within the harvested area, retention of 10 percent or more of the existing structure would be accomplished by leaving suitable trees, or clumps of trees generally greater than 16 inches dbh, as well as non-merchantable trees (less than 9 inches DBH), un-merchantable trees, (greater than 66 percent defect), safe snags, and large woody debris. The 10 percent retained should be reasonably windfirm, and situated to last well into the rotation. It should be protected by unit design and layout, or contract provisions, or both. All proposed harvest units in the Tuxekan Project include an equal number of acres to be harvested and acres that would be deferred or reserved from harvest, therefore meeting the marten and goshawk requirements using the 1 to 1 factor for stand retention. For several units, deferred or reserved areas are larger than the harvested areas. See Table 3-72 for deferred or reserved acres for the CCR units.

Due to the modification of the CCR prescription, the harvested portions of the CCR units would lack sufficient residual vegetation to provide habitat for marten. However, this should be compensated by the fact that the residual stands left in the reserved or deferred areas would not be lost to windthrow. There are a few cases where existing or proposed new roads are located in the reserve area of a CCR unit. It is recognized that these areas do not contribute to meeting the marten guidelines and the acreage lost within the road clearing would be accounted for during unit layout in the field. During field layout, crews would include road clearing acreages along with harvest unit acreages (in CCR units) in calculating the acres needed for deferral.

Table 3-94 shows the amount of high-value marten habitat in the harvest units for each alternative. Currently, 6,316 acres of the Tuxekan project area can be classified as high-value marten habitat. Alternative 3 would have the greatest impact on high-value marten habitat, 533 acres (8 percent decrease), while Alternative 4 would have the least, 355 acres (6 percent decrease). These results are the worst-case, as they include the harvesting in STS units. While the STS units would not be high-value habitat after harvest, they would maintain structure, snags, and downed logs required by martens. Table 3-94 also shows percent change based on harvesting of just the CCR. Alternative 4 has increased emphasis on the use of STS harvesting and has the least overall effect on marten habitat.

Table 3-94. Projected total and CCR harvesting in high-value marten habitat in analysis area (NFS land)

	Alt 2	Alt 3	Alt 4	Alt 5
Total harvest in HV habitat (acres)	410	533	355	487
% change from existing	-7%	-9%	-6%	-8%
CCR harvest in HV habitat (acres)	339	462	258	416
% change from existing	-6%	-8%	-4%	-7%

Note: high value is high volume strata below 1,500 feet elevation

Coarse-structured (multi-aged, large trees) low elevation forest can also be addressed using timber volume classes 6 and 7 (from the GIS cover existveg). The analysis area contains a

total of 5,048 acres of volume class 6 and 7 stands. There would be a 6-9 percent decrease in volume class 6 and 7 stands as shown in Table 3-50.

Where marten mortality concerns have been identified, the Forest Plan specifies studies on mortality factors and interagency cooperation on management practices, including road management and hunting/trapping regulations, to maintain marten mortality levels at sustainable levels (USDA FS 1997a). Concerns have not been raised for Tuxekan Island. The Forest Plan requires effective road closures as a measure to reduce marten mortality that has been caused by an increase in road access. Road construction by alternative is described in the “Road Management” section of this chapter. The construction of proposed temporary and NFS roads would have short-term effects (less than 10 years) to marten by increasing the possibility of mortality due to trapping. Table 3-95 shows the open road densities and total road densities (includes both NFS and temporary roads), both during project activities, and after implementation of the Access Management Plan.

The access management plan has been designed to reduce open-road density in the analysis area in all action alternatives. After project completion and implementation of the access management plan, the open-road density of the analysis area would be reduced from the current 1.4 mile per square mile to 0.8 mile per square mile in all action alternatives. Table 3-95 shows these road densities.

Currently the marten trapping season in Game Management Unit 2 (GMU 2), which is Prince of Wales Island and the outer islands to the west, runs from December 1 to February 15. Since the winter shut-down period is from approximately November to mid-April, there would be no overlap between project activities and trapping season. Trapping pressure would not increase due to workers being on the island, but could increase temporarily while new roads are open and providing access into new areas. Current levels of road access have not resulted in concerns of overharvesting of marten. Not all new roads would be open at the same time, so open road densities would not go up quite as much as shown in Table 3-95, but the new roads would still provide access into new areas. All action alternatives would result in an overall decrease in ORDs after implementation of the Access Management Plan.

Table 3-95. Road densities during and post-project

Roads (density - mi/sq mi)	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
During project activities					
Total Road Density	2.2	2.5	2.6	2.4	2.6
Open Road Density	1.4	1.6	1.7	1.6	1.7
After implementation of Access Management Plan					
Total Road Density	2.2	2.3	2.4	2.4	2.4
Open Road Density	1.4	0.8	0.8	0.8	0.8

Note: Total road density after implementation does not include temporary roads that were decommissioned

The old-growth reserve strategy of the Forest Plan was designed to meet the habitat needs of old-growth associated species, including the marten. The old-growth strategy was developed

by VCU. The four affected VCUs serve as the cumulative effects analysis for the old-growth reserve strategy and these effects are shown in the biodiversity section. Alternatives 4 and 5 fully implement the interagency recommendations, while Alternative 2 makes slight modifications to the proposed interagency boundaries. Alternative 3 meets Forest Plan direction but does not fully incorporate the interagency recommendations. Alternative 4 best addresses connectivity, followed by Alternative 5 (see Biodiversity section).

Edge habitats created by harvesting and road construction may be favored by some species, such as some species of raptors, which could result in increased predation of marten in the edge habitats. Marten generally avoid areas that lack overhead cover, but this varies by geographic area. Marten in Southeast Alaska generally select habitats that provide overhead cover, and loss to predators along edges may be mitigated by that fact.

Overall, there would be a reduction in high value marten habitat as a result of implementation of any of the action alternatives. When looking at high-value habitat, using high volume old-growth there is a 2 percent difference between all action alternatives. When using volume class, there is only a 1 percent difference between the action alternatives. Short-term increases in open road densities may lead to temporary increased vulnerability to trappers. Alternatives 3 and 5 would have the greater effects, but Alternative 5 is mitigated through the incorporation of the interagency OGRs. Implementation of project activities proposed in all alternatives may adversely impact individuals but are not likely to result in a loss of viability in the Planning Area, not cause a trend toward federal listing.

American Marten Cumulative Effects

The cumulative effects analysis area for marten is Tuxekan Island (project area). The timeframe used incorporates the effects of past and reasonably foreseeable timber harvesting and is limited to the direct reduction of marten habitat. Effects of future, non-foreseeable projects would be addressed as part of the analysis of effects for those projects.

The old-growth reserve strategy of the Forest Plan was designed to meet the habitat needs of old-growth associated species, including the marten. The project area lies within a high risk biogeographic province for marten, and more than 33 percent of the POG either has been harvested or will be based on foreseeable actions (including the proposed harvest). Currently about 44 percent of the island is in second growth. Alternatives 2, 3, and 5 would increase this to 47 percent, while Alternative 4 would increase the amount of second growth to 46 percent of the island. Early seral conifer stands are thought to provide low quality habitat for marten. While most of the past harvesting was done before implementation of the current Forest Plan recent harvesting has incorporated Forest Plan snag direction. While there may be some snags left in harvesting areas that were inaccessible or in areas where they were not a safety concern, overall past harvest units (prior to 1997) are now deficient in snags. They would likely remain this way for at least 100 years as the stands lack large trees, and standing snags.

Approximately 419 acres or 21 percent of the total riparian management area was harvested prior to 1990. In addition, there have been 1,730 acres of beach/estuary buffer harvested prior to 1990, mostly on the west side of the island. The effects of these past harvests were incorporated into the connectivity analysis.

There are no reasonably foreseeable future timber sales on either federal or non-federal lands. There have been approximately 2,145 acres of precommercial thinning. Current

precommercial thinning plans (King Tux) are to thin 1,291 acres of second growth. Precommercial thinning could improve stand and habitat conditions over the long-term, but would have no effect on improving habitat for marten over the short-term.

There are approximately 6,316 acres of high-value marten habitat in the project area (Tuxekan Island); or about 36 percent of the island is high-value habitat. Table 3-96 shows the quantity of high value habitat remaining after implementation of the alternatives.

Table 3-96. High-value (HV) marten habitat in the project area (Tuxekan Island)

Alternative	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres HV habitat	6,316	5,906	5,783	5,961	5,829
Percent of project area	36%	33%	33%	34%	33%

Source: GIS volstrata

The amount of high value habitat has been greatly reduced over the project area due to past harvest(approximately 44 percent of the island is now in second growth). Adjustment of small OGR boundaries to meet interagency recommendations (Alternatives 2 (with modifications), 4 and 5) would best contribute towards the Forest Plan goal of maintaining viable marten populations across the landscape.

Alexander Archipelago Wolf Affected Environment

The Alexander Archipelago wolf (*Canis lupus ligoni*) was chosen to show the effects of road construction impacts and forest fragmentation on wildlife. In Southeast Alaska, wolves are found in all habitat types but seem to prefer the naturally occurring mosaics of forest and muskeg that provide an abundance of prey. Wolves in Southeast Alaska prey primarily on Sitka black-tailed deer. Black bears, marine mammals, salmon, waterfowl, and small mammals supplement wolves' diet in the area (ADF&G 2003). Two Alaskan subspecies of wolf are currently recognized. The wolf found in Southeast Alaska is known as the Alexander Archipelago wolf. The Alexander Archipelago wolf inhabits the mainland and the large islands south of Frederick Sound.

ADF&G Game Management Units (GMU) 2 and 3 support approximately 60 to 70 percent of the total population in Southeast Alaska(the project lies in GMU 2). The total population was estimated to be between 700 and 1,100 wolves in autumn of 1995 (Person et al. 1996). Wolf densities on Prince of Wales (POW) and adjacent islands are generally higher than on nearby mainland. Wolves are capable swimmers and regularly travel between islands in search of prey (ADF&G 2003). Person (2001) suspects that the wolves of the POW island complex constitute a single breeding population. There is no permanent wolf pack on Tuxekan Island. The Staney Creek pack spends most of its time on POW but uses Tuxekan for part of the year. No denning activity has been observed on Tuxekan.

Tuxekan Island was part of a comprehensive study of wolf ecology on POW and nearby islands (Person 2001). He found a strong inverse relationship between home range size and the proportion of critical winter habitat for deer. Person predicts that the wolf population in GMU 2 would likely decline by 25 percent between 1995 and 2045 as a result of the combined effects of past timber harvesting and future management according to the Forest

Plan (Person 2001). Deer populations are affected by the combination of deep snow winters and large amounts of winter range converted to second growth. Snow reduces or eliminates deer forage availability in young clearcuts. Closed-canopy, second-growth stands provide little forage for deer in all seasons. He further predicts that the population of wolves could be reduced further by 2045 due to decreased deer populations and wolf mortality (legal and illegal). Person concludes that road access facilitates human-caused mortality and recommends, for the long-term viability of wolf populations, that the number of roads physically open to human activity be substantially reduced (in Hanley et al. 2005).

The Forest Plan FEIS contains an interagency wolf conservation assessment developed in cooperation with USFWS and ADF&G. This assessment identified three main considerations important to wolf viability. These are deer populations (as primary prey species); the need to have large roadless and unfragmented reserves where intensive harvesting has occurred; and open road densities and their contribution to excessive, human-induced wolf mortality. The wolf assessment describes a reserve system of approximately 50,000 acres (the approximate core activity area of one wolf pack) for every 192,000 acres of landscape where wolves occur. The assessment found that wolf mortality increases substantially when open-road density exceeds 0.7 mile of road per square mile.

Current deer habitat capability in the project area is estimated to be approximately 48 deer per square mile. A habitat capability of 17 deer per square mile is required to meet both sustainable wolf populations and human deer harvesting demands (TPIT Clarification Papers 1998). More recent estimates recommend a minimum of 18 wolves per square mile to meet both wolf populations and human deer harvesting demands (2000 Monitoring and Evaluation Report). Current estimates of deer habitat capability exceed these goals. See the Sitka black-tailed deer analysis in the Management Indicator Species section and Table 3-90. Deer model results for more information.

When the wolves of the Stanley Creek pack are on Tuxekan Island they benefit from isolation from the POW road and ferry system and lack of permanent communities are on the island. Impacts from existing and proposed roads on Tuxekan Island are much less than equivalent conditions on POW. The existing small OGRs are small, ranging in size from 580 acres to 700 acres. There is only one small section of existing, open drivable road (approximately 300 ft) in the small OGR for 5570. The “unroaded” analysis for this project found three unroaded areas on the island, all under 1,000 acres. Two of these unroaded areas correspond to existing OGRs, while the third one is on the extreme north end of the island.

Depending on the size of the area analyzed the effects of mortality from all sources on the sustainability of wolf populations may or may not be a concern (D. Person, ADFG, pers. comm.). For GMU 2 (POW Island and neighboring islands) population sustainability is assured by invoking the State of Alaska’s percent harvesting guideline. When the harvesting guideline is reached, hunting and trapping seasons can be closed. However, GMU 2 has “hot spots” where wolf mortality is not sustainable (D. Person, ADFG, pers. comm.). North-central POW is one of these areas. The Staney Creek wolf pack is in this “hot spot” and Tuxekan Island is part of the home range of the Staney Creek pack. At various times of the year the pack swims to Tuxekan Island and stays for several weeks before returning to POW (D. Person, ADF&G, pers. comm.).

Based on analysis of trapping and hunting mortality by wildlife analysis area (WAA), it was determined that mortality in Southeast Alaska was correlated with the linear length of roads in the WAAs (Person et al. 1996). There are currently 58.8 miles of existing roads on

National Forest System lands for a total road density of 2.2 miles per square mile. Of these existing roads, approximately 62 percent (36.6 miles) are open either to off-highway or high-clearance vehicles, for an open road density of 1.4 miles per square mile.

For an island (such as Tuxekan) that is isolated from the main road system, D. Person estimated probabilities of the risk of unsustainable mortality depending on open road density (D. Person, ADFG Biologist, June 24, 2002, pers. comm.). For a density of 2 miles per square mile or greater, unsustainable mortality is practically guaranteed. He estimated that for 1 mile per square mile there is approximately a 50/50 chance in a given year that unsustainable mortality will occur.

Alexander Archipelago Wolf Mitigation

- If a wolf den were found, management activities would be designed to avoid abandonment according to Forest Plan Standards and Guidelines (Forest Plan pg 4-116 and 4-117).

Alexander Archipelago Wolf Direct / Indirect Effects

The effect of the Tuxekan Project on the wolf population is shown by analyzing the impact to deer habitat capability, maintenance of core, secure habitats, the increase in human activity on the island, and the changes in access provided by road construction proposed by the alternatives, as well as implementation of the Access Management Plan.

A habitat capability of 17 deer per square mile is required to meet both sustainable wolf populations and human deer harvesting demands. Recent recommendations have suggested that 18 deer per square mile is appropriate (2000 Inventory and Monitoring Report). All the action alternatives would result in deer habitat capability above these levels by the years 2010 and 2054 (see Sitka black-tailed deer section). Therefore, impacts to deer habitat capability would not have long-term effects on wolves prey base. Deer distribution would likely change in the units themselves, as a result of changes in stand structure, depending on season and snow depth. These changes in distribution would have no effect on a highly mobile species like wolves.

All action alternatives improve the ability of the small OGRs to provide secure habitat for wolves, even though they are small and were not designed with wolves in mind. This is due to larger size, and well as re-drawing the boundaries to have them better meet the Forest Plan criteria (see the Biodiversity section). Alternatives 2, 4 and 5 provide the most improvement and would be most beneficial to wolves. All action alternatives have similar effects on currently unroaded areas that might provide some secure habitat. The eastern and western unroaded areas (that correspond to small OGRs) are unaffected and would remain unroaded and provide secure habitat. The northernmost unroaded area has a unit with a temporary road location under all alternatives. Once the temporary road is decommissioned, it may provide some secure habitat, although walk-in access to hunters and trappers would be improved.

During timber sale activities there is generally a greater risk of increased mortality from hunting, trapping, and illegal harvesting due to the increased presence of people and higher open road densities. However, since the wolf hunting and trapping season (December 1 to March 31 in GMU 2 for the 2005 season) coincides with the normal winter shutdown of logging operations, the number of people on the island during the winter hunting and trapping seasons would not increase as a result of the project. There is still the potential for

increased mortality from illegal harvest. Alternative 3 results in the highest number of level of human activities and therefore has the greatest potential for illegal wolf mortality from humans. Alternative 5 would be pretty similar but would have a little less risk than Alternative 3 (see Socioeconomics sections for comparison of alternatives on number of jobs).

Hunting and trapping of wolves and illegal (unreported) harvesting may increase with an increase in accessibility. For an island (such as Tuxekan) that is isolated from the main road system, probability estimates of the risk of unsustainable mortality, depending on open road densities, have been estimated (Person 2002). For isolated islands with open road density of 2.0 miles per square mile or greater, unsustainable mortality is certain. At densities of 1.0 mile per square mile, isolated islands have a 50/50 likelihood that unsustainable mortality would occur in a given year (D. Person ADFG Biologist, pers comm.).

There are currently 58.8 miles of existing roads on National Forest System lands for a total road density of 2.2 miles per square mile. Of these existing roads, approximately 62 percent (37miles) are open either to off-highway or high-clearance vehicles, for an open road density of 1.4 miles per square mile. During the life of the Tuxekan Project, Alternative 3 would have more new road (temporary and NFS) miles and the highest total road density of the alternatives. Alternatives 3 and 5 would have the same total road densities during project activities. Implementation of the proposed access management plan for all action alternatives would reduce the open road density from the existing 1.4 miles to 0.8 miles per square mile. Total road densities dropped due to decommissioning of the temporary roads. However, NFS roads are included as they would still provide walk-in access the hunters and trappers and provide a source of mortality to wolves. Table 3-95 shows open road densities (1.6 to 1.7 miles per square mile) and total road densities during project activities, and after implementation of the Access Management Plan (0.8 miles per square mile). All action alternatives, as well as the existing condition, have open road densities that are over 1.0 mile per square mile during project activities. However, after the project, the action alternatives would have an open road density of 0.8 miles per square mile, while under the No Action Alternative (1), open road densities would stay at 1.4 miles per square mile. All action alternatives would drop the open road density below the 1 mile per square mile that Person predicts a 50/50 chance of unsustainable mortality.

Based on the potential impacts to deer populations, the increase in human activity while sales are active, and the amount of roads, Alternative 3 would have the greatest effect on wolves, followed by Alternative 5 and then Alternatives 2 and 4. These impacts would be offset somewhat by road closures discussed in the “Road Management” section. The lack of a permanent community on Tuxekan Island would tend to reduce sustained hunting and trapping pressure on wolves during the hunting and trapping season. Under the No Action Alternative, open road densities would remain over the level that was suggested to have a 50/50 percent likelihood of unsustainable mortality (D. Person, per. Comm.).

Alexander Archipelago Wolf Cumulative Effects

The cumulative effects analysis area for wolves includes all of Tuxekan Island, as well as part of POW Island. The timeframe used incorporates the effects of past and reasonably foreseeable timber harvesting. Effects of future, non-foreseeable projects would be addressed as part of the analysis of effects for those projects.

It is assumed that the planned work to be done on the existing MAF (not tied with this project) would not result in an increase in use or access to hunters or trappers. The existing MAF already has a ramp that allows small barges that can carry vehicles or ATVs to unload.

The deer model projected an estimated deer density of 23 deer per square mile over the project area and 25 deer per square mile over the WAA in the year 2054. This incorporates the changes in forest structure from past harvests, as well as this proposal, and meets the required 17 deer per square mile to meet wolf viability and hunter demand (and the recommended change to 18 deer per square mile).

The only other vegetation management project planned on Tuxekan (on federal and non-federal land) is pre-commercial thinning of previously harvested stands. This thinning began in the summer of 2005 and would not overlap in time with activities from this project. Increased numbers of people on the island and the risk of mortality to wolves would not be affected.

On POW, there are three timber sales planned on state lands around Naukati Bay, which is across Tuxekan Narrows. Assuming worst case that they would be clearcuts with smaller beach and riparian buffers, the main effect would be on deer habitat (decreasing winter habitat and temporarily increasing summer forage).

The Staney Creek pack is at risk due to ease of access for hunting and trapping from the roads in the Staney Creek drainage. Ferry service to POW also adds to the number of people that utilize the area for hunting and trapping. In recent years the pack has sustained 50 to 75 percent mortality while they are in the Staney Creek drainage and estuary. No harvesting was reported on Tuxekan Island between 1995 through 1999 (Turek 2001) and trapping pressure is considered to be low (Person, pers. comm. 2002).

While the entire home range of the Staney Creek wolf pack is not known, there are a few reasonably foreseeable projects that could be within their range on POW. These include a commercial thinning project north of Naukati, scheduled to be implemented in 2006; another commercial thinning northeast of Naukati that is currently on hold; and the Staney Creek Timber Sale that is in the Staney Creek watershed and currently scheduled to be implemented in 2007. These projects could overlap the same time period as the harvesting on Tuxekan. While Tuxekan Island usually acts as a refuge from disturbance on POW, disturbance and increased human activities associated with this project in combination with activities on POW could result in temporary changes in distribution. Project activities should not overlap with the hunting or trapping season, so Tuxekan could still act as a refuge during that period.

Because all action alternatives (1) maintain deer habitat capability over the long term; (2) result in lowered open road densities (there is a lack of a real hard basis for the 1 mile per square mile threshold, it is based on personal opinion of D. Person, who has done work on wolves in Southeast Alaska but does not have real, published peer-reviewed data to support a specific road density); (3) low hunting and trapping pressure on Tuxekan (again based on D. Persons professional opinion, June 24, 2002); and (4) that GMU 2 does not have a sustainability problem due to a state 30 percent Harvest Guideline that allows closing the hunting and trapping season when guidelines are reached (D. Person, pers. comm.June 24, 2002), there should be no long-term cumulative effects on wolf populations.

Hairy Woodpecker Affected Environment

The hairy woodpecker (*Picoides villosus*) was chosen as an MIS because of its preference for stands of older western hemlock and Sitka spruce and for its association with snags. The hairy woodpecker is a primary excavator that creates cavities in trees, which are then used by numerous other species. Many species of mammals and birds in Southeast Alaska, including owls, hawks, waterfowl, bats, squirrels, martens, and otters, nest or den in tree cavities. Several of these species depend exclusively on cavities in large-diameter snags characteristic of old-growth stands.

Because the hairy woodpecker nests in cavities, snag density has a direct relationship with population levels. Primary habitat is considered to be old-growth forests in patches larger than 500 acres (USDA FS 1997a). Old-growth forests provide the highest snag retention levels and continually supply snags to the forest. The Forest Plan contains standards and guidelines that prescribe the provision of habitat for cavity-nesting species, including the retention of reserve trees (hard or soft snags) within all LUDs (USDA FS 1997a).

Coarse-structured (multi-aged, large trees) low elevation forest is important for several wildlife species including deer, goshawk, forest songbirds, and cavity nesters. Timber volume classes 6 and 7 (from the GIS cover existveg) are believed to be an adequate predictor of those types of stands (Caouette et al. 2000). The analysis area contains a total of 5,048 acres of volume class 6 and 7 stands, as shown in Table 3-92.

Hairy woodpeckers were observed several times in the Tuxekan analysis area in 2000. No specific surveys have been made to estimate its population distribution or density.

Hairy Woodpecker Mitigation

- Retain reserve trees (hard or soft snags) in all LUDs for cavity nesting species.

Hairy Woodpecker Direct / Indirect Effects

Future snag recruitment would be provided through retention of snags in reserve areas of CCR units; as well as retention of an average of eight large trees per acre and 3 dead or dying trees per acre in the STS units. Table 3-97 shows the amount of POG habitat remaining, and percent change, by alternative. The assumption used to calculate this table was that STS units still have sufficient canopy cover and snags to provide habitat. Only the CCR units were taken out. Alternative 3 has the greatest effect as this alternative incorporates more CCR units. Alternative 4 has the least effect as it incorporates less harvest, and places more emphasis on the use of STS methods.

Table 3-97. Hairy woodpecker habitat in the analysis area by alternative

Alternative	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Acres POG	8,633	8,271	8,142	8,349	8,189
Percent change from existing	0%	-4%	-6%	-3%	-5%

Source: Based on POG minus acres of CCR harvest

Based on the protection provided by the standards and guidelines, in combination with the small OGR system on the island, the project is not expected to have significant impacts on the hairy woodpecker.

Hairy Woodpecker Cumulative Effects

The cumulative effects analysis area for hairy woodpecker is Tuxekan Island (project area). Harvesting to date has generally been by clearcutting of old-growth stands (7,844 acres). Much of the earlier harvesting did not leave include snag retention and most of these second growth stands are expected to lack snag habitat. The cumulative effects on cavity nesters would be similar to overall old-growth habitats; see the biodiversity and old-growth section.

The amount of POG habitat has been greatly reduced over the project area due to past harvest; 44 percent of the island is second growth. Adjustment of small OGR boundaries to meet interagency recommendations (Alternatives 2 with modifications, 4 and 5) would contribute towards the Forest Plan goal of maintaining viable hairy woodpecker and other cavity nester populations across the landscape.

Red-breasted Sapsucker Affected Environment

The red-breasted sapsucker is a summer resident of Southeast Alaska and is closely associated with old-growth forest with snags. Low volume classes of old-growth receive more use than higher volume classes of old-growth (TLMP FEIS 1997, p3-356). Sapsuckers were seen and heard regularly on Tuxekan Island during goshawk and owl surveys in 2000. No specific surveys were made to estimate their population distribution or density.

There are 8,633 acres of productive old-growth forest in the analysis area (Table 3-49), of which 510 acres are low volume classes (Table 3-45).

Red-breasted Sapsucker Direct / Indirect Effects

Based on the protection provided by the standards and guidelines, in combination with small OGR system on the Island, none of the alternatives are expected to have significant impacts on red-breasted sapsuckers. Table 3-45 POG by volume strata in the Analysis area (NFS lands) shows the acres of productive old-growth that would be retained, by alternative. There would be a three to six percent decrease in POG, depending on the alternative chosen. STS harvesting would retain enough structure that the residual stand would still be productive old-growth and would move it into a lower volume class, improving habitat suitability for this species.

Red-breasted Sapsucker Cumulative Effects

The cumulative effects analysis area for sapsuckers is Tuxekan Island (project area). The timeframe used incorporates the effects of past and reasonably foreseeable timber harvesting and is limited to the direct reduction red-breasted sapsucker habitat. Effects of future, non-foreseeable projects would be addressed as part of the analysis of effects for those projects.

Timber harvesting on Tuxekan Island began in 1920, and since that time, approximately 7,844 acres of old-growth forest has been harvested in the project area. Harvesting to date has generally been by clearcutting of old-growth stands. These second growth stands are

expected to not provide habitat for this species. There are no other reasonable foreseeable future timber sales that would further reduce productive old-growth habitats.

The amount of POG habitat has been greatly reduced over the project area due to past harvest. Adjustment of small OGR boundaries to meet interagency recommendations (Alternatives 2 with modifications, 4 and 5) would contribute towards the Forest Plan goal of maintaining viable red-breasted sapsucker populations across the landscape.

Bald Eagle Affected Environment

Bald eagles and their nests are provided protection under the Eagle Protection Act. Data from the USFWS Bald Eagle Atlas (USFWS 2001) indicates that eagles have nested in the beach fringes of Tuxekan Island for many years. Approximately 66 nests have been recorded on Tuxekan since surveys began in 1969. Stream survey crews reported several bald eagles along coastal areas during the survey months of April to July 2000 (Nielsen 2001). Bald eagle surveys in the project area conducted by the USFWS in June 1999 found several new nests. At least 20 of the previously recorded nests were not found and are no longer present (M. Jacobson, USFWS Raptor Biologist, pers. comm.). Only a percentage of nests would be active during any given year. Eagles periodically move nest sites, and natural forces often damage others. All nests identified in the project area are within the no-harvest beach fringe buffer.

There has been approximately 1,730 acres of harvesting in the beach/estuary buffer prior to 1990.

Bald Eagle Mitigation

- Survey the shoreline for active bald eagle nests yearly where it is within ½ mile of blasting or within ¼ mile of repeated helicopter activity. If active bald eagle nests are found adjacent to rock pits proposed for use, or where temporary or NFS roads are proposed, appropriate timing mitigation would be applied. All nest trees would be considered active from March 1 to May 31. From June 1 to August 31, trees with nests containing eggs or young as indicated by observation of eggs, young eagles, or by the presence of adult eagles engaged in nesting activities would be considered active.

Bald Eagle Direct / Indirect Effects

There would be no direct effects on nesting habitat for bald eagles due to implementation of the beach/estuary and riparian buffers.

The USFWS and Forest Service maintain an interagency agreement for bald eagle habitat management in the Alaska region (USDA FS 2002). A 330-foot (primary) and a 660-foot (secondary) radius of protective management zones surround all identified nest trees. The maintenance of a 330-foot habitat management zone around nest trees is meant to restrict, where necessary, activities that are inconsistent with current bald eagle use. Where activities appear unavoidable, a variance would be requested from the FWS. Due to the implementation of the beach buffer, the only features associated with this project that could be within the 330-foot buffer around nest trees are existing features; the beach facility around the MAF and any existing roads already located within this buffer. The nearest known nest tree is over 1,000 feet from the MAF and associated road system.

Active eagle nests within 0.5 mile of blasting or within 0.25 miles of helicopter flight corridors (noise disturbance) may require timing restrictions (outside of March 1 to August 31) or written coordination with USFWS.

The TPIT Clarification Paper (1998) identifies that surveys to determine the presence of active nests are likely necessary in the following circumstances: 1) when blasting within ½ mile of the landward extent of the 1,000 foot beach fringe; 2) when any construction or reconstruction is planned within the 1,000 foot beach fringe; and 3) when helicopter yarding corridors or other areas of repeated flights or landing would include the coastline and the 1,000 foot beach fringe.

If any of these three situations exist, USFWS should be consulted to assess the need to conduct bald eagle nesting surveys. Local topographic features that may shield the shoreline and nesting bald eagles from blasting or other management activities may be considered, during the assessment to determine the need to do surveys. Surveys are not necessary if disturbance occurs outside of the nesting season (August 31 to March 1). Any restrictions placed on project activity may be removed if the eagle nest(s) becomes inactive after May 31.

There are five existing rock pits within 1,000 foot of the shoreline; three around Scott Lagoon, one near Shikat Point, and another on the west side of Jinhi Bay. The only other area within the 1,000 foot beach/estuary buffer where there is expected to be activity is Nichin Cove, where the MAF is located. There is no proposed temporary road or proposed NFS road within this buffer under any alternative. There is one existing road in the buffer (1470500) that needs some relocation and reconstruction. While there are no known nests along Scott Lagoon, the road is within the 1,000 beach buffer and the area would be assessed for the need for surveys before blasting would occur during the nesting season.

There are 21 existing rock pits within ½ mile of the shoreline. Units with proposed temporary or NFS road construction within the ½ mile buffer are shown in Table 3-98.

Table 3-98. Units with road construction within ½ mile of the shoreline

Unit no.	Temporary or NFS	Alternatives
556-409	temporary	2-5
557-403	Class (1470000)	2-5
557-405	temporary	2-5
560-401	Class and temp	2-5
560-402	temporary	2-5
560-409	temporary	3 and 5
560-417	temporary	3-5
560-426	temporary	2,3 and 5
587.2-412	temporary	2,3 and 5
587.2-413	temporary	2,3 and 5

There are two helicopter units that are within the ¼ mile disturbance buffer; 556-451 and 557-426 and timing restrictions may apply.

If active bald eagle nests are found along the shoreline adjacent to any of the previously mentioned features (rock pits, roads, helicopter units), appropriate mitigation would be considered and applied where needed to reduce the potential for disturbance.

Implementation of project activities proposed in all alternatives may adversely impact individuals but are not likely to result in a loss of viability in the Planning Area, not cause a trend toward federal listing.

Bald Eagle Cumulative Effects

The cumulative effects analysis area for bald eagles is Tuxekan Island (project area). The timeframe used incorporates the effects of past and reasonably foreseeable timber harvesting and is limited to the direct reduction of bald eagle habitat. Effects of future, non-foreseeable projects would be addressed as part of the analysis of effects for those projects.

There have been 1,730 acres of beach/estuary buffer harvested prior to 1990, mostly on the west side of the island. Some of the pre-commercial thinning has been done within the beach/estuary buffer, and this is no longer suitable nesting habitat. Any future activities occurring within this buffer would be evaluated for potential effects.

There are no reasonably foreseeable future actions planned within beach-estuary buffer, so no additional effects are anticipated.

Other Species of Concern

Other species of concern that were analyzed include endemic terrestrial mammals, marbled murrelets, great blue herons, sandhill cranes and other raptors. There is a low potential for measurable effects to great blue herons, and sandhill cranes. Great blue heron rookeries are fairly easily observed and if one is found in the project area Forest Plan mitigation will apply. Sandhill crane habitat would not be directly affected as they use marsh wetlands. If a nest is found, Forest Plan direction includes mitigation measures to reduce effects from disturbance. Analysis for these species is found in the project planning record.

Great Blue Heron Mitigation

- Protect active great blue heron rookeries. Sites would be protected with a 600-foot windfirm buffer, where available. Road construction in this buffer is discouraged. Prevent disturbance during the active nesting season (generally March 1 to July 31).

Sandhill Crane Mitigation

- Conduct activities to avoid or minimize disturbance to habitats within the forest, riparian and estuarine areas which are important to nesting, brooding, rearing and molting for sandhil cranes.

Endemic terrestrial mammals

Several studies have occurred on the Tongass to address small mammals and endemic species. Some of these studies included Tuxekan Island. In addition, the Pacific Northwest Research Station has been conducting a long-term study to identify the existence of endemic

mammal species throughout Southeast Alaska. Because of these past and ongoing surveys and studies, project-specific small mammal trapping was not done.

After review of several studies (Cook et al. 1999; Cook et al. 2001; Smith et al. 2001), along with additional information from Joe Cook (Associate Professor at UNM), and Winston Smith (research wildlife biologist at Forestry Sciences Laboratory in Juneau), and follow-up analysis of habitat associations and potential for addressing affects, only two endemic mammal species, the American marten and the Prince of Wales flying squirrel, were carried forward for analysis. For more information on these studies, information from communications with Cook and Smith, see the Wildlife Update in the planning record (7/05).

The American marten was addressed in the MIS section, and the Prince of Wales flying squirrel, along with the marbled murrelet and other raptors, are addressed below.

Species Accounts

Prince of Wales Flying Squirrel Affected Environment

The Prince of Wales flying squirrel (*Glaucomys sabrinus griseifrons*) is a nocturnal species that has often been associated with old-growth forest. Landscape connectivity was believed to be an important factor for flying squirrel viability because of this species' limited mobility. The Prince of Wales flying squirrel was part of a group of endemic mammals evaluated for potential risks to viability in the Forest Plan Final EIS (USDA FS 1997b). Among the endemics, it was rated as having the highest risk of not sustaining viable populations maintained over time, largely due to its dependence on unfragmented old-growth forest (USDA FS 1997b). Habitat factors important to northern flying squirrels include large live trees, large snags, fallen trees, multilayered canopies, and connectivity between habitats through large contiguous areas of habitat or through corridors of suitable habitat (USDA FS 1997b). However, since that time it has been found that peatland-mixed conifer habitat likely contributes to breeding populations of flying squirrels (Smith and Nichols 2003). The risk of extirpation in managed landscapes is less than was presumed during Forest Planning because non-commercial forests contribute to breeding populations and this was not factored in the viability analysis (Smith and Nichols 2004).

There are 8,633 acres of productive old-growth forest in the analysis area (NFS lands on Tuxekan). Based on existing vegetation data, there are approximately 1,060 acres of muskeg and low productivity mixed conifer sites that may be similar to the peatland-scrub mixed conifer forest type that was found to be used by flying squirrels.

Cook et al. (2001) found two genetic lineages of flying squirrels, but with low levels of divergence. The subspecies found on Tuxekan is an endemic, found on the POW Island complex.

Prince of Wales Flying Squirrel Mitigation

- Improve size and composition of small OGRs to meet Forest Plan direction
- The STS units would have less than 30 percent of the unit volume and/or less than 50 percent of the existing canopy designated for harvest. The residual canopy, along with the regeneration would result in a mosaic of multiple age classes, maintaining forested structure for connectivity.

Prince of Wales Flying Squirrel Direct and Indirect Effects

All action alternatives would address flying squirrel habitat through modifications to the four small OGRs in the Tuxekan project area. Each small OGR would meet or exceed Forest Plan minimum size requirements and POG requirements. Alternative 4 would provide the most protection of current corridors between small OGRs in the analysis area and have the lowest effect to the flying squirrel through deferral of several harvest units followed by Alternative 5. The principal stream corridors are Karheen Creek (east-west), the north fork of Karheen Creek (north-south), and two east-west creeks near Scott Lagoon on the western coast. Alternatives 2 and 3 would have the greatest effects on flying squirrel movement due to harvest of units 560-405 and 560-428 that disrupt a portion of the east-west corridor between the small OGRs in VCUs 587.2 and 560. In all alternatives, unit placement, reserve area locations, and the STS with reserves prescription for unit 560-412 would maintain the north-south corridor. Alternatives 4 and 5 provide a wider corridor between the small OGRs in VCUs 587.2 and 557, compared to Alternatives 2 and 3. Based on acreage harvested, Alternative 3 would have the greatest impact followed by Alternative 2. Alternative 4 would have the least impact to the flying squirrel, followed by Alternative 5. Implementation of riparian and beach/estuary buffers would also contribute to maintance of connectivity between OGRs.

Table 3-45 POG by volume strata in the Analysis area (NFS lands) shows the amount of productive old-growth that would provide habitat after implementation of any of the alternatives. Alternative 3 has the greatest effect as this alternative incorporates more CCR units. Alternative 4 has the least effect as it incorporates less harvest, and places more emphasis on the use of STS methods.

Because of the new information on use of other habitats, the risk of extirpation is predicted to be lower than analyzed for the Forest Plan. The small OGR strategy of the Forest Plan was designed to meet the needs of old-growth associated species. The additional requirements for stand structure under the marten and goshawk standards and guidelines would also maintain the value of habitats for flying squirrels. Implementation of project activities proposed in all alternatives may adversely impact individuals but are not likely to result in a loss of viability in the Planning Area, not cause a trend toward federal listing.

Prince of Wales Flying Squirrel Cumulative Effects

The cumulative effects on flying squirrels would be based on those for overall old-growth habitats. See the biodiversity and old-growth section for more information. The effects of past timber harvesting were incorporated into the development of the Interagency small OGR recommendation. In addition, the past harvesting was considered during the connectivity analysis. See the Biodiversity and Old Growth section for more information.

The only foreseeable future action is timber management in previously harvested stands (pre-commercial thinning). Pre-commercial thinning would open up young stands over the short-term, but would result in the maintenance of connectivity over the long-term. These effects would not vary by alternative.

Marbled Murrelet Affected Environment

The marbled murrelet (*Brachyramphus marmoratus*) is a small seabird found throughout the North Pacific. Murrelets feed on small fish and invertebrates in nearshore marine areas,

inland saltwater areas, and occasionally inland freshwater lakes. During the breeding season, marbled murrelets are more dispersed but would still concentrate in feeding areas during the day. Recent studies have shown that murrelets in Southeast Alaska consistently travel considerable distances (up to 124 km) between potential nesting and foraging areas (in Hanley et al 2005).

Marbled murrelets generally select old-growth stands and large-diameter trees as nest sites (Ralph et al. 1995; DeGange 1996). A small percentage (less than 10 percent) of birds may nest on the ground (DeGange 1996). Large limbs of old-growth trees are the preferred area for nest placement. The importance of canopy cover is unclear. High canopy cover within the stand may limit ease of access to the nest. However, high canopy cover at the nest site is believed to contribute to nest success by concealing nests from predators. Therefore, mid-volume stands with large trees may receive use as well (DeGange 1996).

Because of the difficulty in finding nests, marbled murrelet nesting requirements are not well established in Southeast Alaska. Tree diameters for two nests discovered on Prince of Wales Island were 31 inches in diameter at base height (DBH) and 80 inches DBH (DeGange 1996). In general, the best or most important habitat is found within large contiguous blocks of high-volume, low-elevation old-growth forest (USDA FS 1997b). The analysis area contains 6,316 acres of high-value marbled murrelet nesting habitat, based on high volume strata GIS.

Ralph et al. (1995) estimated the marbled murrelet population in Southeast Alaska at 96,200. However, a much more thorough study (Agler et al.1995) determined the early summer, on-water population in Southeast Alaska to be approximately 434,000.

Marbled murrelets have been observed on coastal waters near the analysis area. The Forest Service found a murrelet nest in the Jinhi Bay area in 1996. The nest site is in the small OGR located in VCU 557. Nests are very difficult to find, but due to the fairly high population in Southeast Alaska and suitability of habitat they could be expected to be nesting in other areas of suitable habitat on the island.

Marbled Murrelet Mitigation

- Protect active marbled murrelet nests. They will be protected with a 600-foot windfirm buffer, where available. Minimize disturbance during the nesting season (May 1 to August 15).

Marbled Murrelet Direct / Indirect Effects

Table 3-99 shows the amount of high-value marbled murrelet habitat in the harvest units included in each alternative. Alternative 3 would have the greatest impact on high-value murrelet habitat, a 9 percent reduction, while Alternative 4 would have the least impact, a 6 percent reduction. None of the harvesting occurs within the beach/estuary buffer.

Table 3-99. Proposed harvesting in high-value marbled murrelet habitat

	Alt 2 harvest acres	Alt 3 harvest acres	Alt 4 harvest acres	Alt 5 harvest acres
Total acres of high-value habitat = 6,316	411	533	355	488
Percent change from existing	-7%	-9%	-6%	-8%

The only known nest location is in the small OGR around Jinhi Bay (small OGR for 556) under Alternatives 2, 4 and 5. Under Alternatives 1 and 3, the known nest location is on the edge of the small OGR. Helicopter logging of unit 557-433 (Alternatives 3-5) should cause no disturbance as it is over a mile away, and logs would be taken to the west, away from the nesting area. There could be undetected nests present on the island, and project activities could result in the loss of nest trees and disturbance during nesting.

The Forest Service is directed to protect nesting habitat around identified marbled murrelet nests. A 600-foot-radius buffer is to be maintained around all known nest sites (USDA FS 1997b). Road building and fragmentation of forested areas are believed to increase predation by increasing access to marbled murrelet nesting stands by avian predators, especially jays, crows, and ravens (DeGange 1996). Because murrelets seem to prefer forest stands close to the water, the 1,000-foot beach fringe buffers and RMAs should protect some potential nesting sites (USDA FS 1997b). Based on the modifications to the old-growth reserve strategy, beach and shoreline buffers and the large population of marbled murrelets in Southeast Alaska, the project is not expected to have a significant effect on the marbled murrelet. Implementation of project activities proposed in all alternatives may adversely impact individuals but are not likely to result in a loss of viability in the Planning Area, not cause a trend toward federal listing.

Marbled Murrelet Cumulative Effects

- The cumulative effects on marbled murrelets would be similar to those on overall old-growth habitats; see the biodiversity and old-growth section.

Other Raptors Affected Environment

In addition to goshawk surveys, owl surveys were conducted on Tuxekan Island in April 2000 (URS 2002c). Field crews followed the latest protocols suggested by Boreal Partners in Flight, with listening stations spaced at approximately 1 mile intervals on the road system (Andres 2000). During the 27 total stops surveyed in the Tuxekan analysis area, 15 northern pygmy owls (*Glaucidium gnoma*), four great horned owls (*Bubo virginianus*), and five northern saw-whet owls (*Aegolius acadicus*) were detected. All owls breed in a variety of coniferous and deciduous habitats and feed on small birds, mammals, and insects. The relative abundance of northern pygmy and saw-whet owls, which nest in old woodpecker holes and natural cavities, suggests that the project area contains a significant amount of suitable cavity nest sites and supports substantial populations of prey species. Conservation of these owl species is therefore linked to the success of conservation for primary excavating species such as hairy woodpeckers and other cavity-using species (such as pygmy owls and saw whet owls).

The only other raptors observed by the survey crews were a sharp-shinned hawk (*Accipiter striatus*) and a possible red-tailed hawk (*Buteo jamaicensis*). The sharp-shinned hawk preys mostly on small birds and builds its nest in conifers from 10 to 60 feet up from the ground. No nests were found although specific raptor nest surveys were not required. Forest Service personnel have also observed red-tailed hawks on Tuxekan Island in 1995 (E. Lance, USDA Forest Service Wildlife Biologist, pers. comm. 2001).

Other Raptors Mitigation

- Protect active raptor nesting habitat. Sites will be protected with a 600-foot windfirm buffer, where available. Road construction in this buffer is discouraged. Prevent disturbance during the active nesting season (generally March 1 to July 31).
- Retain reserve trees (hard or soft snags) in all LUDs for cavity nesting species.

Other Raptors Direct / Indirect Effects

The Forest Plan contains standards and guidelines that provide for the protection of raptor nests (hawk and owl nests), including a 600-foot buffer around active nests and minimal disturbance during nesting season. No nests were discovered in any of the harvest units proposed under any of the alternatives; however there could have been undetected nests in some of the areas. If nests are detected, Forest Plan Standards and Guidelines would be implemented.

Several of the species (such as pygmy owls and saw whet owls) detected during surveys are cavity nesters. Future snag recruitment would be provided through retention of snags in reserve areas of CCR units; as well as retention of an average of eight large trees per acre in the STS units. Table 3-49. POG in the analysis area after implementation of CCR harvesting (NFS lands on Tuxekan Island) shows the amount of suitable POG habitat remaining, by alternative. Based on the protection provided by the standards and guidelines, in combination with the small OGR system on the Island, the project is not expected to have significant impacts on these species. Any nesting pairs that are not discovered prior to project activities may be affected depending on time of year and distance between the nest and activity. Implementation of project activities proposed in all alternatives may adversely impact individuals but are not likely to result in a loss of viability in the Planning Area, not cause a trend toward federal listing.

Other Raptors Cumulative Effects

The cumulative effects analysis area for raptors is Tuxekan Island (project area). The timeframe used incorporates the effects of past and reasonably foreseeable timber harvesting and is limited to the direct reduction of raptor habitat. Effects of future, non-foreseeable projects will be addressed as part of the analysis of effects for those projects.

Timber harvesting on Tuxekan Island began in 1920, and since that time, approximately 7,844 acres of old-growth forest has been harvested in the project area. Much of the earlier harvesting did not leave include snag retention and much of these second growth stands are expected to lack snag habitat.

The effects of past timber harvesting were incorporated into the development of the Interagency small OGR recommendation. In addition, the past harvesting was considered during the connectivity analysis. See the Biodiversity and Old Growth section for more information.

The only foreseeable future action is timber management in previously harvested stands (pre-commercial thinning). Pre-commercial thinning would open up young stands that are currently unsuitable for most of these species, but would result in the maintenance of connectivity of forested habitat over the long-term. These effects would not vary by alternative.

Fisheries

Fisheries Affected Environment

The17,730-acre Tuxekan Island project area encompasses all twenty-one watersheds of Tuxekan Island. The project area contains six anadromous stream systems catalogued by ADF&G. These streams drain into Scott Lagoon, Karheen Cove, Tuxekan Passage, Guhao Inlet, and Sea Otter Sound. The project area also contains many inland and coastal streams, including 20 additional anadromous stream systems not catalogued by ADF&G. There are 25 lakes and ponds in the project area, representing a total lake surface area of 295 acres. For this analysis, the cumulative effects area is the same as the project area; the twenty-one watersheds of Tuxekan Island (see Chapter 3 – Hydrology – General Affected Environment Figure 3-3. Location map of watersheds within the Tuxekan Project Area and Table 3-12. Watersheds within the Tuxekan project area, size, and where they flow).

Three of the watersheds (Watersheds 4, 5, and 12) are true watersheds, maintaining at least third-order streams. Seven watersheds (Watersheds 2, 3, 6, 8, 9, 10, and 14) are coastal watersheds with at least one true watershed among several stream systems. Two watersheds (Watersheds 13 and 15) have no documented surface stream systems. The remaining six watersheds (Watersheds 1, 7, 11, 16, 17, and 18) are coastal watersheds with less than a third-order stream network. VCUs have land area that approximates a third order or greater sub watershed. The project area encompasses four VCUs: 556, 557, 560, and 587.2.

Please refer to the Watershed section (this Chapter) and the *Soils, Geology, Mineral and Wetland Resources Inventory Report* and the *Watershed Assessment Report* located in the planning record for a more thorough over-view of the project area and watersheds.

Fish Species

Anadromous fish species spawning in freshwater streams or lakes within the project area include pink (humpy or humpback) salmon (*Oncorhynchus gorbuscha*), coho (silver) salmon (*O. kisutch*), sockeye (red) salmon (*O. nerka*) steelhead (anadromous rainbow) trout (*O. mykiss*), sea-run coastal cutthroat trout (*O. clarki clarki*), and Dolly Varden char *(Salvelinus malma*) (URS 2002a). Resident freshwater game species include resident coastal cutthroat and resident Dolly Varden char. Resident freshwater non-game species include sculpin (*Cottus* sp.) and three-spine stickleback (*Gasterosteus aculeatus*). Spawning, rearing, juvenile, and adult migration life stages are supported in these anadromous stream systems. Chinook salmon (*O. tshawytscha*) have not been documented in project area streams or lakes but are found surrounding marine waters off the project area. The estuaries and surrounding marine waters are heavily used and vitally important to anadromous species during various life stages.

Pink salmon is the most abundant anadromous species in the project area. This species is common in the lower gradient reaches of all anadromous fish-bearing streams on Tuxekan Island. Chum salmon are present in many of the larger anadromous streams on Tuxekan Island. ADF&G catalogued streams document presence of coho salmon, pink salmon and sockeye salmon Coho salmon have the widest spawning and rearing distribution of the obligate anadromous salmonids in Southeast Alaska, and are found in many of the fishbearing streams throughout the project area.

Sockeye salmon are present in the Karheen and Kugan Point Creek drainages and rear in Karheen Lakes 1 and 2 and Kugan Point Lake (ADF&G 1992). Spring runs of steelhead trout in the Karheen Creek drainage are the only documented populations of rainbow trout on the island, although it is possible that other populations of rainbow trout exist in the larger stream systems of Tuxekan Island. Coastal cutthroat trout and Dolly Varden char are found primarily in high gradient streams.

All of the anadromous fish species contribute to the commercial fish industry, resident sport fishery, subsistence user, sport charter boat and lodge operator; and are a valuable food source for bears, eagles and other wildlife.

The primary recreational fishing areas on Tuxekan Island are located in Nichin Cove, Karheen Cove, the lower portion of Karheen Creek, the three Karheen lakes, and Kugan Point Lake. Local residents are also believed to harvest clams and other shellfish in Scott Lagoon, Jinhi Bay, and Guhao Inlet.

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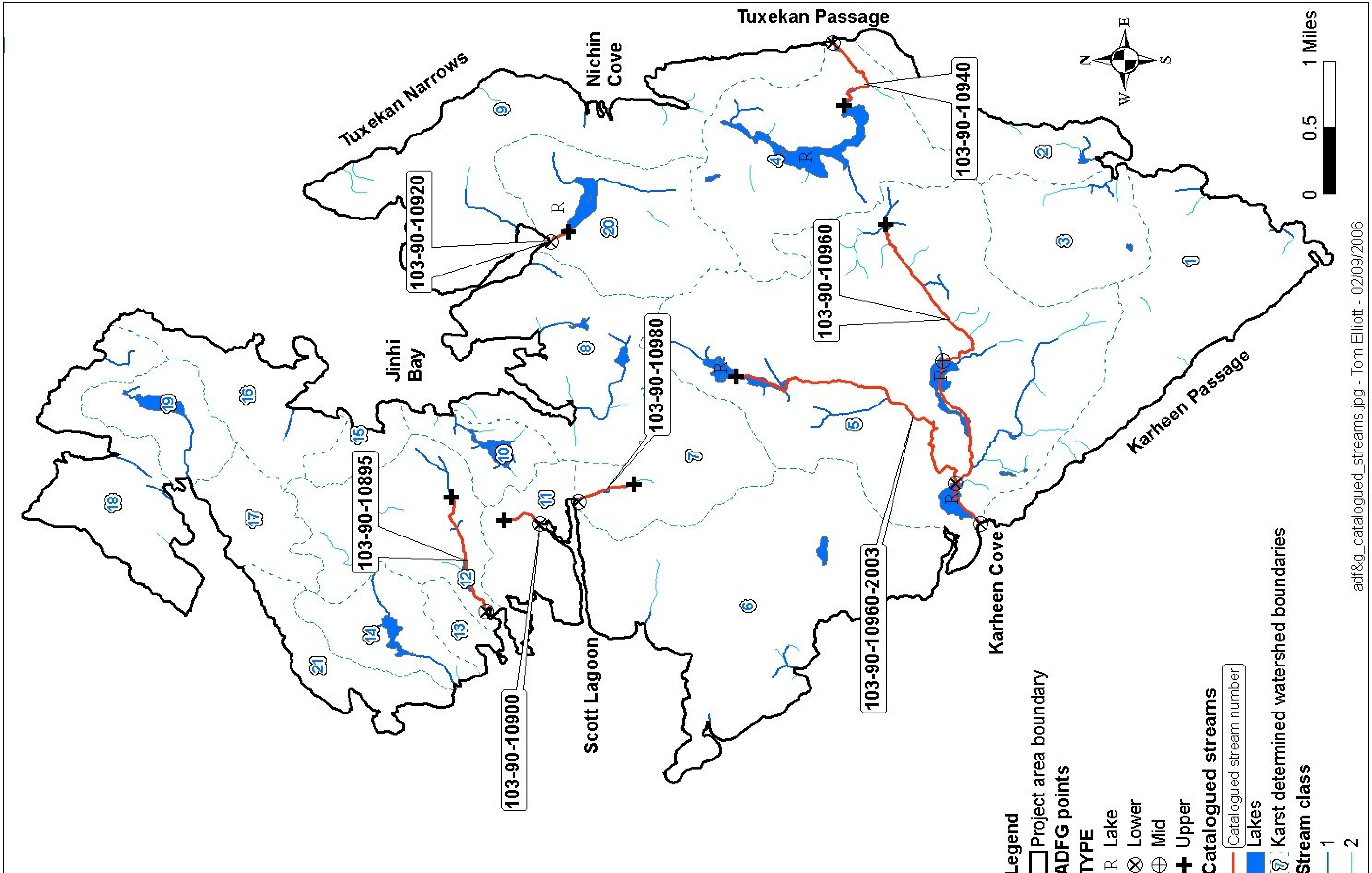

Figure 3-9. ADF&G catalogued streams within the Tuxekan Island Project area

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Management Indicator Species

Pink salmon, coho salmon, Dolly Varden char, and coastal cutthroat trout were selected as Management Indicator Species (MIS) in the Forest Plan. Pink salmon were selected to represent anadromous fish that are limited in their freshwater life-period by spawning gravel quality and quantity. Coho salmon represent anadromous fish that are generally limited in their freshwater life-period by stream and lake rearing areas. Dolly Varden char were chosen for their distribution in freshwater habitats; and coastal cutthroat trout for their dependency on small freshwater stream systems that are most susceptible to effects from management activities.

Federal Threatened and Endangered Species

No threatened, endangered, or candidate fish species occur in streams within the project area (Grossman 2001). However, four evolutionarily significant units (ESUs) of chinook salmon that are listed as threatened migrate past the project area in marine waters: the Lower Columbia River Chinook, the Upper Willamette River Spring Chinook, the Snake River Fall Run Chinook, and the Puget Sound Chinook (URS Corporation, 2002). No critical habitat for any of these ESUs occurs in Alaska waters, and no take would occur under Section 9 of the Endangered Species Act (NOAA Fisheries 2001).

Forest Service Region 10 Sensitive Species (R10SS)

Sensitive fish species on the R10SS list include: northern pike (*Esox lucius*), Fish Creek chum salmon (*Oncorhynchus keta*), and King Salmon River and Wheeler Creek king salmon (*Oncorhynchus tshawytscha*). None of these species, however, are known to occur in the project area. Thus, there would be no effect to R10SS or habitat. No further analysis is needed.

Fish Habitat

Stream Class

Stream classes are a means to categorize stream channels based on the instream habitat and fish production value. Streams are separated into four class designations for the Tongass National Forest according to the Aquatic Habitat Management Handbook (USDAFS 2001, Ch 10, pgs 7-8). Stream class definitions are as follows:

- Class I: Streams and lakes with anadromous or adfluvial fish habitat; or high quality resident fish waters, or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish,
- Class II: Streams with resident fish or fish habitat and generally steep (often 6-25 percent or higher) gradients where no anadromous fish occur, and otherwise not meeting Class I criteria,
- Class III: Perennial and intermittent streams with no fish populations or fish habitat, but sufficient flow or sediment and debris transport capability to directly influence downstream water quality or fish habitat. These streams generally have bankfull widths greater than 1.5 meters (5 feet) and channel incision greater than 5 meters (15 feet); other

streams not meeting these requirements may be cataloged as Class III streams based on professional interpretation of stream characteristics.
- Class IV: Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to directly influence downstream water quality or fish habitat capability. These streams generally are shallowly incised into the surrounding hillslope.

There are also “non-streams” which are not mapped and cataloged. These are: rills and other watercourses, generally intermittent and less than one foot in bankfull width, showing little or no incision into the surrounding hillslope or evidence of scour.

Based on field surveys and interpretation of aerial photographs, approximately 40 miles of Class I and Class II fish-bearing streams are in the project area Of these fish-bearing streams, approximately 29 miles are anadromous, Class I streams. Within the project area, there are approximately 115 miles of non-fish-bearing Class III and Class IV streams (URS 2002b) and 295 acres of freshwater lakes.

Channel Types and Process Groups

Channel typing stratifies stream and lake sections within a watershed into different stream process groups. The process groups are based on physical characteristics of streams and describe the interrelationship between watershed runoff, topography, geology, and glacial or tidal influences on fluvial erosion and deposition. Process groups allow the prediction of the physical responses of streams to different management activities. (For a description of stream process groups, see pages D-1 to D-8 of the Forest Plan.).

Channel types and associated process groups are also an indicator of the quantity and quality of fish habitat within the project area. The quantity and quality of rearing habitat predicted by the various channel types has been established through field studies within the Tongass National Forest Generally speaking, the floodplain (FP) channels provide the greatest amount of spawning area for salmonids and much of the rearing habitat. Moderate gradient mixed control (MM) channels can also provide good spawning and rearing habitat in the lower gradient sections. Palustrine (PA) channels are areas with low water velocities, which are important rearing areas for juvenile coho salmon (USDAFS 1992).

There are eight process groups within the project area. The high gradient contained (HC) process group makes up a large portion of the project area (approximately 10 miles). This process group, along with the more moderate and large gradient contained (MC and LC respectively) groups, are typically resilient to watershed disturbances (USDA 1992). The palustrine (PA) process group makes up about 9 miles of the project area and is associated with lowland landforms and wetlands. The process groups that provide anadromous fish habitat, FP, MM, and PA make up about 16 miles, or 40 percent of the project area. The majority of stream miles for each of the FP, MM, and PA process groups are located in Watershed 5.

For additional information on streams, lakes, and wetlands in the project and cumulative effects areas please refer to the *Tuxekan Island Fisheries Resource Report*, the *Watershed Assessment Resource Report*, and the *Soils, Geology, Mineral and Wetland Resources Inventory Report*, which are located in the planning record. For a more in depth discussion of streams, lakes, and wetlands in the project area see the Hydrology section in this chapter.

Riparian Management Areas

Riparian management areas (RMAs) are land areas delineated in the Forest Plan to provide for management of riparian resources. The Forest Plan defines riparian areas as "…areas [which] encompass the zone of interaction between the aquatic and terrestrial ecosystems, and include riparian streamsides, lakes, and floodplains with distinctive resource values and characteristics" (USDA FS 1997a, pg 4-53).

National Forest Management Act regulations prohibit any activities near streams that would adversely affect fish habitat (36 CFR 219.27 (e)). In addition, the Tongass Timber Reform Act (TTRA) of 1990 requires a no-harvest buffer zone of at least 100 feet on each side of all Class I streams, and all Class II streams that flow directly into Class I streams process group classification, as explained above (USDA Forest Service 1992; Forest Plan, pages 4-53 through 4-73). These measures include increased buffer widths of up to 140 feet or greater along of Class I, II and III streams and are specified in the unit cards in Appendix B.

Windthrow/Windfirm Buffers

Forest Plan Standards and Guidelines direct the Forest Service to provide for reasonable assurance of windfirmness to the RMA buffers when harvesting timber units. The risk to buffer integrity due to windthrow can be estimated based on direction of prevailing storm winds, slope aspect, topography, tree species, stand structure and prior evidence of windthrow. Southeast Alaska's damaging winds are from the southeast to southwest direction and are channeled along waterways (Harris, 1989). In the Tuxekan Project area, prevailing storm winds are from the south, however, most of the units throughout the island experienced high to moderate storm events with evidence of windthrow hazard, such as small to medium scale gaps throughout stands.

Past Disturbance

Timber Harvesting in RMAs

Acres of timber harvesting by watershed RMAs since the start of timber harvesting in the 1920s within the project area is presented in Table 3-100. RMAs provide streams with nutrients, shade, large woody debris (LWD), and bank stability. Approximately 419 acres or 21 percent of the total RMA acres were previously harvested. Watersheds 6, 11, 16, and 20 have all had greater than 50 percent of the RMA acreage previously harvested.

The majority of productive, fish-bearing streams in the Tuxekan Project area are recovering from pre-1997 Forest Plan management practices that included road building on floodplains and alluvial fans; harvest and conversion of dominant riparian plant species; and the removal of in-stream LWD. Although there is a lack of systematic data available on salmonid populations pre- and post-logging in Alaska, Bryant and Everest, 1998 predicted that logged watersheds would be less resilient to environmental stresses than intact watersheds and that salmonid populations would therefore be more vulnerable to environmental disturbances such as decreased marine survival, drought, landslides, and flooding.

Table 3-100. RMA in Tuxekan Island project area, percentage of RMA previously harvested, and length of fish streams in previously harvested RMA

Watershed	Acres of RMA	Acres of Previously Harvested RMA	Percentage of RMA Previously Harvested	Class I Stream Length (feet) in Previously Harvested RMA	Class II Stream Length (feet) in Previously Harvested RMA	Class III Stream Length (feet) in Previously Harvested RMA	Class IV Stream Length (feet) in Previously Harvested RMA
1	105	24	23	0	1,085	3,801	0
2	45	1	2	0	0	549	0
3	56	2	4	0	0	909	8
4	224	36	16	485	1,672	1,894	0
5	631	79	13	5,276	3,369	2,950	0
6	71	48	68	2,844	3,797	129	0
7	35	16	46	1,207	761	18	0
8	127	26	20	2,312	793	1,626	0
9	169	51	30	4,627	2,799	6,244	0
10	74	6	8	126	308	412	0
11	7	7	100	693	0	0	0
12	100	40	40	3,552	1,578	0	0
14	75	2	3	73	0	0	0
16	10	7	70	966	79	0	0
17	5	1	20	0	0	4,183	0
18	60	9	15	574	0	0	0
19	56	2	4	0	0	0	0
20	99	53	54	0	0	0	0
21	25	9	36	0	0	0	0
Total	**1,974**	**419**	**21.2**[a]	**22,735**	**16,241**	**22,715**	**8**

Source: URS Fisheries Report, Table 9
[a] Total is the average of total RMA prior harvest

Timber Harvesting and Associated Road Building

Past timber harvesting and associated road building is thoroughly discussed *under Chapter 3, Issue 1, Water Quality Past Disturbance, Road*. In general, road densities range from 0.0 to 5.0 miles per square mile, with Watershed 7 having the highest road density. This watershed encompasses 666 acres and is centrally located on Tuxekan Island. Runoff generated from rainfall in this watershed flows into Scott Lagoon via surface and subsurface pathways. Roads were constructed in this watershed, and others, to access past harvest acres.

As mentioned, RMAs are important resources for aquatic species as well as water quality and overall watershed health and function. The greatest risk to the fisheries resource is generally caused by roads. Increased sediment yield, including yields from roads during construction, use during timber harvest activities, and lack of sufficient maintenance or proper closure following timber harvest activities, are activities that can increase sediment delivery to important rearing and spawning stream systems.

Stream Crossings and Associated Fish Passage

In addition to road densities and proximity to streams, the number of road crossings influences sediment delivery as well as fish passage. Providing for fish passage at stream and road intersections is an important consideration when constructing or reconstructing forest roads. Improperly located, installed, or maintained stream crossing structures can restrict fish movement, thereby adversely affecting fish populations. Culverts are typical stream crossing structures that inhibit fish movement. The most common obstacles at culvert outlets are vertical barriers, debris blockages, and excessive water velocities caused by culverts installed with increased gradients and/or constriction of the stream channel through undersized culverts.

Based on information from the Thorne Bay GIS and RCS database (October 2005) the Tuxekan project area includes 44 stream crossings, 17 of which cross Class I streams; 8 which cross Class II streams, 12 which cross Class III streams and 7 which cross Class IV streams. The majority of the Class I and II stream crossings are in Watershed 5, which includes the Karheen Lake drainage that provides coho, pink, and sockeye salmon spawning and rearing habitat.

In addition to the number of road crossings, the Tongass National Forest has developed a juvenile fish passage evaluation criteria matrix to let managers know whether juvenile fish would be able to migrate through a particular culvert. Culverts are classified as:

- **Green:** has a high certainty of meeting juvenile fish passage at all desired stream flows;
- **Gray:** additional or more detailed analysis is required to determine passage ability; or
- **Red:** has a high certainty of not providing juvenile fish passage at all desired stream flows.

Only 4 of the 44 stream crossings in the Tuxekan Project Area have been categorized using the juvenile fish passage evaluation matrix. The two stream crossings categorized as “red” - impassible are located in Watersheds 7 and 12. The impassible culvert in Watershed 7 is located near the outlet of ADF&G cataloged stream 103-90-10980 on road 1470000, with approximately 0.5 miles of coho habitat upstream of this culvert. The second culvert in Watershed 12 blocks upstream migration in ADF&G cataloged stream 103-90-10895, blocking approximately ½ mile of upstream coho and pink salmon habitat. It is likely that additional “red” culverts may be documented when the remaining fish crossings are evaluated.

Karst Systems

Approximately three percent of the current karst feature inventory of the Tongass is located in the project area. On Tuxekan Island, hydrologic processes in the watersheds are inextricably linked to karst systems. The health of the watersheds can result from particular impacts on karst systems and landforms within and beyond surface watershed boundaries. The Forest Plan states that karst dominated aquatic habitats support a higher abundance, distribution, density, and variety of invertebrate species than non-carbonate based systems, contributing to fish food quality and availability. Karst dominated aquatic habitats also have higher growth rates for smolts (young trout or salmon that have begun their migration from fresh water to the sea) and resident fish, reflect less variable water temperatures and flow

regimes, and contain unique habitat affecting species distribution, abundance, and adaptations (Appendix I, Forest Plan).

Although higher alkalinities observed in karst-influenced streams may have a positive effect on aquatic productivity, other factors also affect productivity and salmonid densities such as well developed gravel substrates, large wood, and complex pools (Bryant et al. 1998). Therefore, riparian protection in these karst-influenced streams is important in maintaining salmonid productivities.

For a discussion of direct and indirect effects to karst features please see the Environmental Effects – Karst Systems earlier in this chapter.

Fisheries Mitigation Measures

The following fish and fish habitat, and riparian standard and guideline objectives are applicable to all LUDs within the project area (Forest Plan FISH112, IV, pg 4-9 to 4-10; RIP1, IIA pg 4-53). In general, maintain riparian areas in mostly natural conditions, for fish, other aquatic life, and old-growth and riparian plant and wildlife species:

- Manage riparian areas for short and long-term biodiversity and productivity.
- Maintain or restore stream banks and stream channel processes.
- Maintain or restore natural and beneficial quantities of LWD over the short and long-term.
- Maintain or restore water quality to provide for fish production
- Maintain or restore optimum water temperatures for salmonids.
- Maintain fish passage through stream crossing structures.
- Evaluate the effect of management of adjacent areas on riparian habitats

Forest Plan Standards and Guidelines require that RMAs be protected according to stream value classification and channel type process groups. Minimum protection standards are defined for harvest activities and activities associated with road building according to the following guidelines.

- All Class I and Class II streams are protected from harvest activities within a minimum horizontal distance of 100 feet from the bankfull margins.
- Additional measures are taken to protect streams based on stream type process group classification (USDA Forest Service 1992; Forest Plan, pages 4-53 through 4-73). These measures include increased buffer widths of up to 140 feet or greater along certain types of Class I, II and III streams.
- Timber harvest is excluded in all v-notches associated with steep side slopes along Class III streams.
- Harvest activities near Class I, II, and III streams require that trees be felled away from the stream and that trees yarded across or along stream courses be fully suspended.
- Class IV streams are treated as part of the hillside under slope stability standards and guidelines. Logging debris introduced into Class IV streams must be removed.
- In addition, the Forest Plan calls for providing reasonable assurance that RMAs are windfirm. Where the risk of windthrow is moderate or greater, RMAs are protected

by leaving some additional windfirm trees standing in the area immediately adjacent to the RMA called "reasonable assurance of windfirm (RAW) buffers".

- BMPs described in the unit and road cards would be implemented to minimize effects to water quality and aquatic habitat.
- To reduce sediment transport to streams as a result of project activities, all temporary roads would be decommissioned after project implementation and all new NFS roads would be put into storage after completion of the timber harvest.
- Proposed new road crossings would be constructed according to the current Forest Plan Standards and Guidelines to allow fish and debris passage.
- Maintenance and reconstruction of existing stream crossings on Class I, II, and III streams would be in conformance with current Forest Plan Standards and Guidelines; and
- Reconstruction and maintenance of the MAF at Nichin Cove would be in the same footprint as the existing permitted MAF to minimize effects to additional Marine EFH. For additional information on EFH please see the Section below, for additional information on the Nichin Cove MAF, see the Transportation Management section of this chapter.

Mitigation measures have been incorporated in the prescriptions for individual units and are provided in the Tuxekan Island Unit and Road Cards in Appendix B and C, and the Tuxekan Island Fisheries Resource Report located in the planning record. Also refer to Appendix D of this document for a complete list of mitigations.

Fisheries Direct / Indirect Effects

The MIS in the project area include coho and pink salmon, Dolly Varden char, and coastal cutthroat trout. It is assumed that the requirements of these species would also meet the requirements of sockeye salmon and rainbow trout. Pink salmon habitat is provided in the lower gradient reaches of all anadromous fish-bearing streams on Tuxekan Island. Spawning and rearing habitat for coho salmon is provided in Watershed 5 (Karheen Creek) and Watershed 4 (Kugan Point Creek) as well as smaller watersheds in FP, MM, and PA channel types. Resident fish most likely spawn in the upper reaches of these tributaries. Coastal cutthroat trout and Dolly Varden char spawning and rearing habitat is generally provided in MM channel types with rearing in lakes.

Fisheries Direct / Indirect Effects Specific to Alternative 1 – No Action

The direct and indirect effects of the No Action alternative on the watersheds in the project area would be a persistence of the existing condition in the short term. No change to MIS fish populations would be anticipated. Over the long-term (30-100 years), harvested acres in the majority of RMAs would be recovered and channel stability increased. Sediment delivery to streams would decrease over the long term as vegetation recovered and unauthorized roads were decommissioned. Road maintenance would be attained as budget and time allowed.

Fisheries Direct / Indirect Effects Common to Alternatives 2, 3, 4 and 5

Windthrow/Windfirm Buffers

Low degrees of windthrow in RMAs surrounding harvest units may occur in each action alternative. The windthrow is not expected to reduce the integrity of the RMA buffer under any alternative. The windthrow risk of each unit was evaluated by the IDT silviculturist, logging specialist, hydrologist, wildlife biologist, soils scientist and fisheries biologist. Factors considered included: 1) the dominant storm track and prevailing winds; 2) topography, including slope aspect; 3) stand structure, tree species and soil factors; 4) buffer location on the landscape; 5) fisheries, wildlife, recreational and other resources at risk; 6) wildlife reserve areas; 7) evidence of windthrow in and around the unit; and 8) type of vegetation treatment to be implemented. The goal was to keep the percent canopy opening in the RMAs similar to the percent canopy opening in the RMA adjacent to the harvest unit. In the Tuxekan Project area, the prevailing storm winds are from the south, though all the units along the edges of the island are at risk. All units with streams were considered to have moderate to high windthrow risk based on evidence of windthrow hazard.

In general, RAW buffers of 75 feet have been assigned to all Class I and II streams, with wildlife reserves providing an additional buffer of 100 to 150 feet, for a total buffer ranging from 175 to 225 feet and sometimes as large as 300 feet (see Appendix B for specific unit buffer widths). In general, all the units with streams were considered high risk, with evidence of windthrow hazard, such as small to medium scale gaps throughout stand. In units with a prescription of STS or CCR by helicopter logging where a majority of the trees would be retained or the unit is very small a RAW buffer was not assigned.

Timber Harvesting in RMAs

No significant direct and indirect effects to MIS species and habitat including water quality, aquatic habitat, salmonid spawning gravel or populations of fish are expected to result from implementation of the action alternatives associated with the Tuxekan Island timber sales. No more than 1.2 acres of RMA would be disturbed with implementation of the project. This is 0.1 percent of the total RMA within the Tuxekan Project Area. Approximately a half acre of vegetation within the RMAs would be disturbed or removed to construct a bridge or arched culvert over a Class I stream in Watershed 18 (road 1470000, common to all action alternatives) and a Class I stream in Watershed 6 (road 1470500 for Alternatives 3 and 5). Other than this disturbance, no timber harvesting would occur within RMAs under any alternative. The indirect effects to RMAs would be a minor reduction in future sources of LWD. The reduction in potential LWD would be limited to the bridge construction site and would have negligible effects on stream shade and bank and channel stability.

Timber Harvesting and Associated Road Building

Alternative 3 proposes timber harvesting on the greatest number of acres (570 total) and proposes to construct the greatest amount of new road (4.7 miles new construction and 4.9 miles of temporary). Alternative 4 would harvest the fewest acres (284 total) and least amount of road construction (3.9 miles new construction and 2.1 miles of temporary). Alternatives 2 and 5 fall between the other action alternatives. Alternative 2 proposes harvesting 491 acres and construction of 3.1 miles of new road and 3.1 miles of temporary

road. Alternative 5 proposes timber harvesting on 444 acres, construction of 4.3 miles of new road and 4.5 miles of temporary roads.

Temporary road construction, road reconstruction, road maintenance, and stream crossing construction would incrementally (directly and indirectly) increase fine sediment delivery to fish bearing streams and lakes. The majority of spawning habitat occurs within the low gradient reaches (less than three percent stream slope) of Class I-II streams, lake inlets and outlets. Sockeye spawning can also occur in lake gravels where sufficient substrate and up-welling are present. Pink salmon are also able to spawn in brackish water of intertidal-influenced reaches associated with estuaries.

Stream Crossings and Associated Fish Passage

The amount of sediment yield anticipated under the action alternatives as a result of proposed stream crossings was presented under *Affected Environment - Sediment Yield Direct/Indirect Effects*. There would be nine stream or karst crossings under Alternative 4, seven crossings under Alternative 2, and 11 under Alternatives 3 and 5, which includes a 50 foot stringer bridge in Watershed 6, over a Class I stream. This bridge is necessary for reconstruction of the 1470500 road. Construction of a 50 foot stringer bridge over a Class I stream in Watershed 18 would occur under all action alternatives (see Appendix C – Road Unit Cards).

There would also be a log stringer bridge crossing the collapsed karst channel on the planned road 1470330 accessing unit 560-408. This bridge would be constructed under Alternatives 3, 4 and 5 and is in Watershed 6.

There are six culverts crossing Class IV streams proposed under Alternatives 2, 3, 4 and 5 (four on proposed NFS roads and two on proposed temporary roads). There is one culvert crossing a Class III stream in Alternatives 3, 4 and 5. There is one culvert crossing a collapsed karst channel in Alternatives 3, 4 and 5.

The Class I streams in Watershed 18 and 6 provide habitat for coho and pink salmon. The Class I stream which would be crossed by road 1470000 in Watershed 18 is a small, low gradient stream with primarily an organic substrate with patches of small gravel and sand resulting in limited spawning habitat. During construction, instream timing windows would be applied between June 25 and September 1 for both structures. Bridge design and installation would follow water quality management BMPs (see Appendix C – Road Unit Cards). No significant direct and indirect effects to MIS species and habitat including water quality, aquatic habitat, salmonid spawning gravel or populations of fish are expected to result from implementation of any of the action alternatives.

Karst Systems

The two main influences by karst on fisheries are water volume and water chemistry. Waters originating in one watershed can and do resurface in other watersheds providing additional flow volume. These waters have higher alkalinities that have been directly related to increased stream productivity, including increased densities of fish populations (Bryant et al. 1998). When flow volume is eliminated or changed due to slash or other debris clogging the karst system, then discharge in other watersheds may be altered. Mitigations for eliminating or reducing direct, indirect and cumulative impacts to the karst resource are summarized under Environmental Consequences - Karst Mitigation Measures. Other factors also influence salmonids productivity and densities such as well developed gravel substrates,

LWD and complex pools. Mitigation measures prescribed for riparian areas, including buffers would minimize any affects on these habitat factors.

Fisheries Cumulative Effects

Cumulative effects result from the incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions. A general discussion of cumulative effects to fisheries resources is found in the Forest Plan (USDA FS 1997b, pgs 3-56 to 3-73).

The cumulative effects analysis area comprises the twenty-one watersheds on Tuxekan Island. In addition, Nichin Cove is included in the cumulative effects area to account for the MAF. The timeframe for the analysis of these effects is the past 50 years. The justification for this spatial and temporal boundary includes the following:

- Watershed boundaries reflect the cumulative impacts of upstream activities
- Dye tracing studies have identified watersheds being hydrologically connected to one another (therefore all watersheds are included in the cumulative effects analysis area including Watersheds 13, 14, and 21 that have no roads or proposed harvest) (Harza Northwest, Inc. 1995)
- Consistent data is available for the past 50 years
- Generally riparian vegetation would begin to recover within this time frame, though full recovery would take approximately 150 years.

Logging has occurred within the project area since 1920 (Refer to Chapter 1 –Past Activities). Logging occurred in the northern portion of the island as early as 1945, with most timber harvesting occurring between 1971 and 1974. Timber harvesting in the central portion of the project area began in 1940 with most harvesting occurring between 1961 and 1974. Logging in the southern portion of the project area began in 1920 near the southern tip of the island, with most harvesting occurring between 1975 and 1986. A small amount of logging occurred in the northern and central portions of the project area between 1995 and 1998. This past harvesting was along approximately 19 percent (7.5 miles) of the total Class I and II stream mileage in the project area (4.4 miles along Class I streams and 3.1 miles along Class II streams) (DEIS pg 3-154). Past harvesting in the RMAs amounts to 419 acres (DEIS pg 3-100). The North Sea Otter Sound EIS resulted in several sales that harvested timber from 1990 to present. Two sales from this EIS were completed as single-tree and group selection. Precommercial thinning has occurred on Tuxekan Island from 1961 to 1973 with total acres amounting to 2,145 (refer to Chapter 1).

The cumulative effects area affected environment would match that of the project area. The following conditions can be attributed to these projects:

- The highest road mileage is in Watershed 5, the Karheen Creek drainage, which provides approximately 12 miles of stream habitat for anadromous fish and contains a series of fish bearing lakes.
- There are 44 stream crossings, with 17 Class I and eight Class II crossings in the project area.
- There are culverts and drainage structures identified as in need of repair based on the RCS database.

- Approximately 419 acres, 21 percent of the total RMA, was previously harvested. Watersheds 6, 11, 16, and 20 have all had greater than 50 percent of their RMA acreage previously harvested.

Current (FY05-06) pre-commercial thinning plans are to thin 1,291 acres of second growth. Ten percent of the thinning was targeted to improve wildlife habitat and one percent to improve riparian habitat. Thinning in riparian areas can help riparian areas recover from previous harvesting by increasing tree growth rate and, therefore, increasing potential large LWD, stream shade, and bank stability.

Reasonably foreseeable actions include possible small salvage sales along existing roads and potential commercial thinning of stands harvested in the 1940s.

Small salvage sales may occur along existing roads, primarily to salvage windthrown timber. Future salvage sales along existing roads are governed by the Forest Plan and the TTRA. No programmed harvesting would occur in RMAs. Salvage harvesting is allowed but only to benefit fish habitat. It is unlikely that habitat damage from windthrown timber would be judged to be severe enough to require removal to benefit fish habitat.

Commercial thinning of a portion of the second growth established in the 1940s may occur around 2010. Second growth stands occur in Watersheds 1, 3, 5, 6, 8, 9, and 18.

The majority of productive, fish-bearing streams in the Tuxekan Project area are recovering from pre-1997 Forest Plan management practices that included road building on floodplains and alluvial fans; harvest and conversion of dominant riparian plant species; and the removal of in-stream LWD. Although there is a lack of systematic data available on salmonid populations pre- and post-logging in Alaska, Bryant and Everest, 1998 predicted that logged watersheds would be less resilient to environmental stresses than intact watersheds and that salmonid populations would therefore be more vulnerable to environmental disturbances such as decreased marine survival, drought, landslides, and flooding.

Many streams that contain fish habitat in areas of regeneration will lack potential LWD recruitment until streamside conifer trees in the RMAs become mature enough to provide new LWD to streams channels (URS Corporation 2002). In contrast, the areas with very little harvest in the floodplain provided recruitment of LWD maintaining channel complexity, creating fish rearing and macroinvertebrate habitat (URS Corporation 2002). If riparian areas are protected by no-cut and windfirm buffers, LWD recruitment should be regained over time. In regeneration units, it may be possible to thinning trees within the RMA with the objective of increasing the growth rate of conifers in the RMA (URS 2002).

Fisheries Cumulative Effects Specific to Alternative 1

Under the No Action alternative, no vegetation management would occur and no road construction or road reconstruction would take place during this planning period. Selection of this alternative would not preclude regular forest stand improvement activities such as precommercial thinning or regular maintenance of roads, including erosion control measures or cleaning of culverts.

Fisheries Cumulative Effects Common to Alternatives 2, 3, 4 and 5

An anadromous fish habitat assessment (AFHA) panel, made up of fisheries biologists and hydrologists, analyzed effects to Tongass fisheries resources for the Forest Plan. The Forest Plan Record of Decision (USDA FS 1997a) states that the standards and guidelines and other

direction approved by the Regional Forester meet or exceed the recommendations of the AFHA panel. Standards and guidelines are sufficient to protect fish habitat and provide for sport and commercial fisheries and subsistence. In addition, site-specific rotation lengths would reduce activity levels in upland sites, reducing the risk to fisheries and riparian resources. Another panel was formed that worked directly on the Forest Plan. The panelist opinions and predicted outcomes from the Forest Plan Final EIS (USDA FS 1997b) that are applicable to the Tuxekan Project are discussed below.

Windthrow/Windfirm Buffers

The 1997 Tongass Forest Plan buffer stability monitoring began in 2000 and is ongoing. On average 3.8 percent of trees were windthrown in all RMAs combined (Landwehr 2006). Within the HC process group, windthrow associated with Class III streams averaged 4.5 percent. Thus it is anticipated that some of the designated RAW buffers will be lost to windthrow. To minimize this impact, most of the RMA buffers are bordered by wildlife deferred areas on at least one side of the buffer.

Timber Harvesting in RMAs

The panelists agreed that, even with the highest level of riparian protection, the risk of impacts on fish could still be relatively high in heavily impacted watersheds due to cumulative effects. In addition, riparian buffers may be subject to potential blowdown, especially those adjacent to previous clearcuts.

Approximately 419 acres of a total 1,974 acres of RMA have been previously harvested in the project area. For the Tuxekan Project, no additional harvesting is planned in RMAs (with the exception of a 0.2 acre for construction of a stream crossing). RAW buffers have been designed to protect no-cut RMAs where they may be subject to potential windthrow (see Appendix B for unit specific RAW buffers). Watersheds 6, 11, 16, and 20 have all had greater than 50 percent of their RMA acreage previously harvested. No harvesting is proposed along Class I, II, and III streams within the designated RMA buffer widths under any alternative for these four watersheds. Lacking harvesting within RMAs, there is limited opportunity for sediment transport into streams. There are existing roads within RMAs, however, some of the unauthorized roads are proposed for storage following project activities. Storing roads may have a short-term increase but a long-term decrease of sediment inputs to streams.

Timber Harvesting and Associated Road Building

The panel also assumed that more roads would be located at higher elevations on less stable terrain, and that timber would be harvested in areas less stable than historically harvested areas. This could result in a greater likelihood of hillslope failure, erosion of fine sediment from road surfaces, and capture and rerouting of natural drainage. Most of the harvested land in the project area has been from the valley bottoms up to mid-slope. The remaining suitable commercial forestlands in the project area are located in patches within a range of slopes and elevations.

Miles of NFS and temporary roads proposed by watershed and alternative is presented and described earlier in combination with harvest in RMAs under Hydrology, Table 3-22. In general, the cumulative percent of disturbance to the RMAs under the action alternatives and

know precommercial thinning projects is less than one percent over existing conditions. The most disturbances to RMAs would be in Watershed 1, 3 and 6.

It is likely that there would be some increase in sediment generated by road maintenance, construction, and timber hauling near streams. Cumulatively, the increases in sediment from road activities, combined with chronic sources of sediment generated from past timber harvesting and road building could incrementally impact salmonid spawning gravels. However, with standards and guidelines identified in the Forest Plan, BMPs, and identified mitigation measures to reduce sediment delivery; it is not likely that the high value habitat of Coho salmon, pink salmon, Dolly Varden char or coastal cutthroat trout would be affected to a measurable extent.

All proposed NFS roads would be stored and proposed temporary roads would be decommissioned. Storing and decommissioning roads would have short-term increases in sediment delivery to streams, but would help restore natural drainage patterns and, in the long term, would reduce sediment delivery to streams.

Stream Crossings and Associated Fish Passage

Under the action alternatives, sediment yields to stream and lake habitats may be increased as a result of road construction, timber hauling, and new stream crossings. In contrast, sediment yield may decrease as a result of increased maintenance of existing roads, specifically reducing the number of plugged and damaged culverts and realigning the road away from tidal influence.

In Watershed 18, the extension of road 1470000 would require crossing a Class I stream. In addition, in Watershed 6, the reconstruction of road 1470500 would also require crossing a Class I stream. The cumulative effects to RMAs from these stream crossing would be minor; a 0.2 acre reduction in future sources of LWD. The reduction in potential LWD would be limited to the bridge construction site and would have negligible effects on stream shade, bank and channel stability.

According to the most recent RCS (January 2006), there are two culverts blocking passage to Class I streams. Repair or replacement of drainage structures impeding fish passage would be planned under the Sale Area Improvement Plan (Appendix E). Reconnecting fish streams would benefit fish populations and open approximately one mile of upstream habitat.

Fisheries Summary

Fine sediment generated from project activities associated with the action alternatives could negatively impact sensitive spawning habitat. However, stream buffers, application of wind firm buffers on specific units, avoidance of steep/unstable slopes, and road construction and stream crossing mitigation measures would be expected to minimize negative direct and indirect effects to a point where impacts to spawning gravel and salmonid production would not be detectable relative to the existing background conditions.

Alternative 3 would pose the greatest potential to generate sediment in the short and long term because of the miles of NFS and temporary road construction and the total acres of timber harvesting. Alternative 4 would be expected to generate the least amount of sediment and therefore pose the lowest risk to water quality, aquatic habitat, spawning gravel and populations of fish over time.

By implementing Forest Plan Standards and Guidelines, BMPs, and utilizing other design and mitigation measures discussed above; direct, indirect, and cumulative effects of the proposed activities on MIS species and habitat would be minimized. The proposed action alternatives would meet Forest Plan fisheries and riparian standard and guidelines, requirements under the Endangered Species Act, Recreational Fisheries and the Coastal Zone Management Act. Additional impacts to MIS species and habitat, and therefore other fish species, are likely to occur only from unforeseen events such as landslides, debris blockages of culverts, and road failures.

Magnuson-Stevens Fishery Conservation and Management Act of 1996

Magnuson-Stevens Fishery Conservation and Management Act of 1996 Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act states that all federal agencies must consult the National Marine Fisheries Service (NMFS) for actions or proposed actions that may adversely affect EFH. Consultation began when NMFS received a draft copy of the EIS with the EFH Assessment. The NMFS has not provided additional conservation recommendations. Incorporation of this Assessment in the FEIS satisfies the consultation requirements.

Essential Fish Habitat Assessment

Freshwater

EFH for Pacific salmon recognizes six critical life history stages: (1) spawning and incubation of eggs, (2) juvenile rearing, (3) winter and summer rearing during freshwater residency, (4) juvenile migration between freshwater and estuarine rearing habitats, (5) marine residency of immature and maturing adults, and (6) adult spawning migration (Roni et al. 1999). Habitat requirements within these periods can differ significantly. Modifications to EFH that can adversely affect these life history stages include both direct effects (e.g., hydrologic modification of spawning and rearing habitat) and indirect effects (e.g., loss of prey species diversity). These effects can be site-specific to habitat-wide and can be chemical, biological, or physical. A given modification to EFH can have individual, cumulative, or synergistic consequences depending upon its nature and extent (Wilbur and Pentony 1999).

Features of freshwater EFH important for spawning, rearing, and migration include adequate substrate composition; good water quality (dissolved oxygen, nutrients, temperature, etc.); appropriate water quantity, depth, and velocity; channel gradient and bed stability; food availability; instream cover and habitat complexity (e.g., LWD, pools, channel complexity, aquatic vegetation); sufficient habitat area; access and passage; and floodplain habitat complexity. The Action Alternatives are summarized in Chapter 1 and described in detail in Chapter 2.

There are approximately 29 miles of Class I streams in the project area that provide EFH for pink, sockeys, chum, and coho salmon. These streams and tributaries provide EFH for pink, chum, sockeye, and coho salmon. Features of EFH that could be adversely affected include substrate composition, water quality and temperature, channel gradient and stability, food availability, cover and habitat complexity, and recruitment of LWD to the stream channel. It is also possible that juvenile and adult migratory access and floodplain habitat complexity could be altered should slides or mass erosion occur. Unmitigated, the road construction

associated with project area development would increase sediment delivery to the streams, increasing turbidity and the potential for slides and decreasing dissolved oxygen and suitable spawning gravels.

These adverse effects on EFH would result from the alteration of riparian and upland areas that modify the delivery and routing of water, sediment, and LWD to the stream channel (Naiman et al. 1992). To protect these habitat features, the same mitigation measures as listed under *Effected Environment – Fisheries Resource – Mitigation Measures,* would be in place for the entire project.

Marine Water

For the proposed actions being considered in the Tuxekan Project Area, the primary concern is the potential for adverse effects on freshwater EFH, although the potential for adverse effects on estuarine habitats is also recognized. Adverse effects include any potential effects resulting from use of the existing Nichin Cove MAF and may include diminished habitat for bottom-dwelling creatures in addition to effects on underwater vegetation used as food and potential rearing sites. Mitigation for potential impacts to EFH is provided by adhering to the MAF guidelines provided in the Forest Plan.

Use of the Nichin Cove MAF is not expected to cause additional long-term bark accumulation. While the MAF is in operation, dive surveys must be conducted annually to monitor bark accumulation. A dive was conducted the last time the facility was in use 2001. The measurement of bark deposition depth and percent of bark coverage was measured by the diver at 15 foot intervals along five transects. The substrate type at this site consisted mostly of rock, gravel and sand. Marine life recorded included sea stars, sun stars, vegetation and eel. There was no continuous cover of bark and only 0.08 acres of discontinous area, well below the Forest Plan interim threshold bark accumulation level of 100 percent coverage exceeding both one acre in size and a thickness greater than 10 cm (3.9 inches) at any point.

The marine water EFH includes the nearshore benthic (organisms living on or at the bottom of a body of water) substrate in the immediate vicinity of the Nichin Cove marine access facility (MAF). In addition, juvenile and adult Chinook, coho, chum, pink, and sockeye EFH species are found near the project area. The inshore areas of the project are used by juvenile salmon during spring and early summer for feeding and predator avoidance prior to migration out to sea.

Primary prey items for these species based on the Gulf of Alaska Fishery Management Plan (NPFMC 1998) include:

- Sculpins, which mainly feed near the bottom, prey on crabs, barnacles, and mussels. Larger sculpins periodically prey on fish.
- Adult coho salmon prey primarily on fish, although pelagic crustaceans and squid are also consumed. Juvenile salmon consume plankton and small crustaceans.
- Adult sockeye, chum and pink salmon feed primarily on plankton and crustaceans such as tiny shrimp can also be consumed.
- Dusky rockfish have a diet mainly of euphausiids, although larvaceans, cephalopods, and pandalid shrimp can also be consumed.

- Arrowtooth flounder feed primarily in gravel-mud substrates near the seafloor. Adults feed on other groundfish, while juveniles feed on euphausiids, crustaceans, amphipods, and young pollock. Larvae feed on phytoplankton and zooplankton.
- Pacific cod are omnivorous. Adult cod feed mostly on other fish such as walleye, pollock, and yellowfin sole. Young cod feed mostly on invertebrates such as amphipods, crangonid shrimp, polychaete worms and bivalves.
- Skates feed primarily on bottom invertebrates (crustaceans, mollusks, polychaetes) and fish.
- Walleye pollock feed throughout the water column on copepods, euphausiids, young pollock and other fish.
- Yelloweye rockfish eat primarily fish including other small rockfish, herring, and sandlance.
- Shortraker and rougheye rockfish feed primarily on shrimp, squids, and myctophids. Juveniles feed on shrimp and amphipods.
- Pacific Ocean perch are overwhelmingly planktivorous. Juveniles eat mostly calanoid copepods and euphausiids.

The Tuxekan Project may adversely affect EFH as a result of vegetation management activities, barging of logs, and associated temporary road building. However, by implementing Forest Plan Standards and Guidelines and BMP's, direct, indirect, and cumulative effects of the proposed activities on EFH would be minimized.

Coastal Zone Management Act

The Coastal Zone Management Act of 1972, as amended, while specifically excluding Federal lands from the coastal zone, requires that a Federal agency's activities be consistent with the enforceable policies of a State's coastal management program to the maximum extent practicable when that agency's activities affect the coastal zone.

The Alaska Coastal Management Program incorporated the Alaska Forest Resources and Practices Act (Forest Practices Act) as the applied standards and guidelines for timber harvesting and processing. The Forest Service standards and guidelines, BMPs, and mitigation measures described in the Tuxekan FEIS meet or exceed the level of protection provided by the enforceable policies of the State Forest Practices Act.

The State of Alaska, Office of Governmental Coordination, has conducted a consistency review of the project and concurs with the Forest Service that the project is consistent with the Coastal Zone Management Act.

Social Environment

Heritage Resources

Heritage Resources Affected Environment

Heritage resources include a wide array of historic and prehistoric cultural sites and traditional cultural properties. The Forest Service conducts heritage resource investigations that follow the Section 106 process of the National Historic Preservation Act (NHPA) as

amended, procedures of the Advisory Council on Historic Preservation (ACHP) (36 CFR 800), and Forest Service policy (FSM 2360) because known and previously undiscovered sites may lie within a project area. Section 106 of the NHPA requires federal agencies, prior to any action, to identify sites that may be eligible for inclusion in the National Register of Historic Places (NRHP) and that may be affected by that action. If significant National Register eligible properties are identified, then federal agencies must take prudent and feasible measures to avoid or reduce adverse impacts and provide the ACHP an opportunity to comment on these measures. If impact is unavoidable, the Forest Service, in consultation with the State Historic Preservation Officer (SHPO) and, potentially other consulting parties, must plan and implement measures to mitigate any effects. A Cultural Resources Analysis Report (USDA FS 2001) was completed for the Tuxekan project area and is located in the project planning record. The following section summarizes that report.

Past Cultural Environment

The human presence on Prince of Wales Island spans at least 10,000 years and is well represented in the archaeological and historic record. The earliest human occupation of Southeast Alaska is known from On Your Knees Cave (49-PET-408) on northern Prince of Wales Island (Dixon et al. 1997). This 10,300 year-old campsite, which also contains the earliest human remains in northern North America, contains evidence of a maritime adapted people who produced bifacial tools and microblades. Other early human occupations of Prince of Wales Island are known from the Chuck Lake Site (49-CRG-096), an 8,200 year-old camp and midden site on Heceta Island, immediately west of the Tuxekan study area, and the Thorne River Site (49-CRG-177), a 7,500 year-old microblade site on east-central Prince of Wales Island.

Native American Ethnography

While both the Kaigani Haida and Tlingit people historically and presently occupy Prince of Wales Island the Tuxekan study area is firmly within the territory of the Heenya kwaan Tlingit people. The Tlingit and other Northwest Coast peoples represent some of the most complex hunter-gatherer societies studied (Ames and Maschner 1999). These hunter-gatherers were socially stratified with slaves and lived in large permanent villages with somewhat sedentary populations. They possessed a complex material culture, monumental architecture, and very high population densities, defying typical assumptions about hunters-gatherers being without possessions and highly mobile (Ames and Maschner 1999).

Prince of Wales Island was formerly divided among several subgroups of Tlingit. The Stikine (Shax'heen) kwaan included the northeast coast of Prince of Wales Island in their territory. The Heenya kwaan inhabited the northern half of the western part of the island. The Klawock (Lawaak) kwaan, who may have also been part of the Heenya kwaan, resided along the west-central coast of Prince of Wales. Finally, the Tongass (Taant'akwaan) kwaan held the southern third of the island before the Kaigani Haida displaced them in the early 18th century (Arndt et al. 1987).

Subsistence and Settlement

The Tlingit round of subsistence relied on highly dependable food sources such as fish and berries. As described by Greiser et al. (1994):

Generally, their annual subsistence cycle consisted of early spring hunting or trapping of mammals on the mainland, halibut fishing in deep waters, eulachon fishing along the shallow coast or in streams, and shellfish and seaweed gathering in shallows; late spring sea otter and fur seal hunting, herring spawn gathering, gathering greens and root, and king salmon fishing; summer intensive salmon fishing and curing, along with berrying by most groups, and harbor seal hunting by northern groups; and fall sea otter hunting generally viewed winter as a time for potlatches and trading, rather than for formal subsistence pursuits. In earlier times, summer was also a time for conducting raids to capture slaves and for a certain amount of trading.

The Tlingit settlement system consisted of occupying at least one main village during the winter and moving to the outer islands as seasons progressed. Located east of Tuxekan, is the winter village of Tuxekan, which was occupied up until the early 1900s. It is very likely that the island of Tuxekan played a role in the subsistence activities of Tuxekan village residents.

Euro-American Contact

Contact between European explorers and the native peoples of Southeast Alaska began in 1741 when Russian explorer Alexei Chirikov lost two boats in a possibly hostile encounter (de Laguna 1990). The Tlingit and Kaigani Haida occupied Prince of Wales Island at the time of European contact, with the Henya Tlingit occupying the region in which Tuxekan Island is located (de Laguna 1990).

Significant Euro-American impact on Tlingit people’s subsistence activities was not experienced until the late 1870s when schoolteachers, missionaries and cannery operations arrived on Prince of Wales Island. In Klawock the first cannery was established in 1878, and a school with a teacher in 1886. By 1900, the remaining Tlingit from Tuxekan village had moved to Klawock. Greiser et al. (1994) notes:

In the 1930s, the Indian Reorganization Act incorporated some villages, such as Klawock, and aided them in acquiring land and sawmills (de Laguna1990:225). Then, in 1971 under the Alaska Native Claims Settlement Act, the Tlingit and Haida formed the Sealaska Regional Corporation in ten remaining historic villages (de Laguna 1990:226). Although industry brought about changes in the life ways of the Tlingit; resulting in a decline in traditional values; tribal identity has not been lost. The clan system, singing and dancing, native crafts, and death customs have experience a strong revival since the 1970s.

Euro-American Activity in Southeast Alaska

The majority of information in this section is derived from Arndt et al. (1987) “A Cultural Resources Overview of the Tongass National Forest.”

Exploration, Trading, and Hunting

The Euro-American history of the region around Tuxekan Island begins around the 1790s. At this time one or two fur traders entered the Tongass Narrows area, followed by the explorer Vancouver in 1794. Fur trade and mining were the main activities in early Euro-American history in Southeast Alaska (for a summary see Arndt et al. 1988). The village of Tuxekan was mentioned in early logbooks as Heenya and a variety of other names (Malloy 1998). Tuxekan village was also visited for trade purposes several times during the 1820s by American vessels due to its proximity to the good sea otter hunting grounds of Sea Otter

Sound (Malloy 1998). Arndt et al. (1987) mentions how Aleut hunters were lured onto foreign fishing/hunting vessels in exchange for some of the catch. One of these vessels visited a bay in the northern Prince of Wales archipelago. The party was attacked by Tlingit or Kaigani Haida and more than 20 Aleuts were killed.

Canneries

The fluorescence of salmon canneries around the turn of the century brought an intensified fishing industry to Prince of Wales Island. Only one such cannery, at the site of Karheen, was known on Tuxekan Island (49-CRG-048). With the intensified fishing industry, fishing techniques changed to include purse seines, pile-driven traps, and floating traps (Arndt et al. 1987). Packing technology advanced with the 1904 invention of the Smith Butchering Machine and the sanitary can in 1912, which helped save labor and assure quality (Arndt et al.1987). The seasonal communities that emerged around the canneries were often divided between Euro-American fishermen and Asian cannery crews. The demand for salmon grew during World War I but the depression caused more than half of the operating canneries to close by 1921. Workers were generally poorly housed in segregated facilities and work conditions did not improve until unionization in 1933 (Arndt et al. 1987). The industry slumped drastically during World War II and years of over-fishing were evidenced in reduced runs (Arndt et al. 1987).

Timber Industry

During the 1850s, Russian and American trading companies began to withdraw from Southeast Alaska in general. There was still an interest in the timber of areas such as the Prince of Wales archipelago, however. In 1907, President Roosevelt established the Tongass National Forest and consolidated it with the Alexander Archipelago Forest Reserve.

The early timber industry in Southeast Alaska consisted of two types of lumber mills; town-based lumber mills, which produced hewn wood for local use, and mills associated with building salmon canneries and mines. Timber harvest for sale outside of Prince of Wales Island did not become a practical market until World War II. At this time the Alaska Spruce Log Program was initiated, as clear spruce was needed for airplane construction. According to Rakestraw (1994) there were nine camps established, “four were floating camps with bunkhouses, cook-shacks, and washrooms. The others were built on shore. One was on the site of the old Indian village of Tuxekan, with totem poles and the chief’s grave in the settlement.” After World War II, large-scale pulp production became economically feasible and several long-term pulp timber contracts were finalized and large-scale timber harvesting operations were put into place.

Previous Investigations

A number of archaeological investigations have taken place in the vicinity of Tuxekan Island since the 1970s. These investigations were conducted largely by the Forest Service or contractors working for the Forest Service. Much of the work has focused on general site inventory, inventory of areas potentially affected by Forest Service management activities, and mitigation of impacts caused by those activities. Prince of Wales Island has been the focus of the majority of these investigations. Surveys performed on Tuxekan Island include several individual timber harvest units in the project area, the project area of the Gap Salvage Timber Sale and several small timber sales. In 1993, Forest Service archaeologists surveyed

approximately 107 of 154 acres in planned harvest units in low sensitivity areas throughout Tuxekan Island. No cultural resources were located. In 1993 and 1994, a portion of the shoreline was surveyed for an oyster farm permit. Twenty-two archaeological and historic sites had been noted in the immediate vicinity of Tuxekan Island prior to the 1995 field season. Site types include permanent villages, summer villages and camps (shell middens of various sizes), cribbed graves, standing totem poles (mortuary type), stone fish traps, wooden stake fish weirs, canoe drags, culturally modified trees, and canoe carving sites.

Project Investigation

A cultural resource analysis of the Tuxekan project area began with a search of cultural resources files, site and survey atlases from Prince of Wales Island Zone, Tongass National Forest, as well as files of the Alaska Heritage Resource Survey (AHRS). Archaeologists also reviewed available literature and conducted heritage resource surveys in selected portions of the Tuxekan project area during 1995 and 1996. Three proposed timber units and 8.5 miles of shoreline were surveyed within the project area. In addition, site monitoring of known coastal sites on Tuxekan Island was performed in 1999 and 2000 as part of the Sea Otter Sound Site Monitoring Project.

Native American Consultation (NHPA 106)

The January 2001 rules implementing the 1992 amendments to NHPA provide for a more active role for Native American tribes in consultation with federal agencies that are planning activities that might affect historic properties on tribal lands. The 2001 rules require that agencies make a reasonable and good faith effort to identify Native tribes who may attach religious or cultural significance to historic properties in a project area. An effort must be made, through consultation, to identify properties of concern within the project area. Assessment of significance and NRHP eligibility for identified sites must be done in consultation with concerned tribes.

In the case of the Tuxekan Island EIS, the project was initiated and archaeological investigations completed in 1995 and 1996, prior to publication of the rules implementing the NHPA amendments. Consequently, tribal governments were not specifically contacted for input prior to fieldwork.

In early 1998, letters were sent to all Tribal governments on Prince of Wales Island describing the Tuxekan EIS and asking for concerns and input from the Tribes. In the fall of 1998, the Zone archaeologist, planner, and District Ranger made presentations to the Klawock and Craig Tribal Councils asking for input. The Forest Service received no formal response from this or other presentations made at subsequent Tribal Council meetings. Sealaska Inc. and the Klawock Cooperative Association (KCA) were consulted for their review of the Cultural Resources Analysis report written for the Tuxekan EIS (USDA FS 2001). Sealaska Inc. has concurred with the determination of ‘No Adverse Effect’ for the project (Letter dated June 13, 2001) and the KCA did not reply.

Survey Strategy

Variable levels of archaeological sensitivity have been established for the Tongass using data collected from previous investigations. These levels allow for the development of a predictive model for determining the probability of site locations. An archaeological

sensitivity zone is an area of land to which an estimate of relative archaeological/historical site density has been attributed, based on the physical, biological, and cultural features and history of the area in question, or on approximately similar areas. The definition of a high-sensitivity zone includes “All land between lower low water and 100 feet of elevation, with no consideration of slope” (USDA FS 1997a). High-sensitivity areas include passes; portages; Class I streams and lakes, including areas of barrier falls; fossil beaches or terraces; areas of caves or rockshelters; myth or legend sites; raw material source areas; lode or placer mining areas; and areas identified by historical, ethnographic, or oral history research. The low-sensitivity zone on the Tongass (and immediately adjacent lands) includes all land not relegated to the high-sensitivity zone. High sensitivity areas for cultural resources within the Tuxekan project area include the seacoast up to an elevation of 100 feet, lakeshores, and stream banks.

Surveys included systematic pedestrian survey and periodic subsurface testing for buried cultural materials using soil probes. All work was initiated in compliance with Section 106 of NHPA. Identified heritage resources were documented in a manner consistent with the standards described in Appendix II of the 1995 Programmatic Agreement (PA) between the Alaska Region of the Forest Service, the ACHP, and the Alaska SHPO (USDA FS 1995). The stipulations were met to satisfy the Forest Service’s Section 106 responsibilities under the NHPA. Formal documentation of surveys and results are filed in the project planning record at the Thorne Bay Ranger District office. Some information pertaining to identified heritage resources is restricted from public access (administratively confidential) because of the sensitive and nonrenewable nature of the resources.

Survey Results

Inventory of the Tuxekan project area concentrated on three areas within the high sensitivity zone: Jinhi Bay, Scott Lagoon and shoreline, and the bay west of Shikat Point. In addition, three timber units and one road were surveyed. The three timber units include unit 556-451, located in the northern half of Tuxekan Island; unit 587.2-425, located west of Nichin Cove on the east coast of Tuxekan Island; and unit 560-406, located in the center of Tuxekan Island on an east-facing slope adjacent to an unnamed lake that drains into the Karheen Lakes. The road, National Forest System road 1470570, is located near the westernmost finger bay of Jinhi Bay, linking it to the head of Scott Lagoon.

The 1995 and 1996 surveys identified eight sites. Narratives for each property that include information on location, topography, vegetation, current condition/impacts, cultural features, artifacts observed or collected, and results of subsurface tests, if conducted, are included in the Cultural Resource Analysis report in the planning record file. Site maps, feature drawings, and detailed description of the sites and their contents, with the site forms, are also included in the report. The sites include three separate rockshelters, two middens with associated culturally modified trees, two surface/subsurface middens, and a fish weir.

All eight of the sites recorded have been determined eligible for nomination for the National Register of Historic Places. The Cultural Resource Analysis Report (USDA FS 2001) documents the eligibility determination process of each site recorded. The Alaska State Historic Preservation Officer concurred with the determinations of eligibility and the determination of no adverse effect in a letter dated November 23, 2001.

A total of thirty archaeological and historic sites are now known from the area of potential effects for the Tuxekan EIS. These include traditional winter villages, camps represented by

shell midden deposits, fish traps, canoe runs, grave sites, and a cannery. Three of these sites lie on Native corporation lands. Twelve of the recorded sites are considered eligible for the National Register of Historic Places. Two are considered ineligible. Eligibility of the remaining 16 sites has not been determined.

Heritage Direct and Indirect Effects

All proposed project alternatives would have no adverse effect on known heritage resource sites in the project area. All of the identified heritage sites lie outside harvest unit boundaries and proposed road locations. Given that the sites are located in sheltered locations far from the harvest units, there should be no adverse effect on these heritage resources as a result of the project operations. Therefore, the development of a mitigation plan for each site is unnecessary for the current project. Some undiscovered sites may exist in the project area. If a new site were to be discovered during layout, a professional archaeologist would evaluate it and mitigation plans would be initiated prior to any work that may adversely affect the resource.

All of the heritage resource information compiled is detailed in a report submitted to the Alaska SHPO. The conclusions state that none of the heritage resources identified would be affected by the proposed alternatives. The Section 106 consultation process was complete on November 23, 2001 with receipt of a letter of concurrence (Alaska SHPO 2001). Consultation with tribes and Native corporations continues as we approach implementation of the decision.

Heritage Cumulative Effects

Threats to significant heritage resources include development, decay, natural landscape changes such as erosion and windthrow, and increased visitation, which might increase erosion or lead to vandalism or looting. Monitoring of known sites would reduce possible impacts by identifying effects, enabling mitigation, and establishing a periodic presence. Beach fringe, stream, and estuary buffer zones, as required by the Forest Plan, would further protect heritage resources from project-related activities. The proposed road additions in the project area would not provide increased access to known paleontological, archaeological, or historical sites. Periodic monitoring of road construction might identify newly exposed sites and enable damage assessment. The 2002 Programmatic Agreement (PA) between the Forest Service and the Alaska SHPO and the ACHP requires monitoring as a component of the inventory strategy. The PA states that for the high-sensitivity zone, “monitor a sample of all direct impact areas during and/or after the actual ground disturbance. Impact areas to be monitored will be determined on a case-by-case basis.” For the low-sensitivity zone, the PA requires “post-disturbance monitoring of a sample of all areas of actual ground disturbance. The locations and acreage sampled will be determined on a case-by-case basis.” There are no known traditional cultural properties in the Tuxekan project area that would be affected by changes in the management of roads or harvest units.

The Heritage Resource Report for the Tuxekan EIS acknowledges a significant cumulative effect of past timber harvest activities, timber camp management, and facilities development on the cultural resources of the area. Historic properties on both Forest Service and private lands have been affected. To mitigate this effect the plan is to continue an aggressive site monitoring program in the Tuxekan area and to continue a public education program to raise awareness of historic preservation laws and ethics.

Any future salvage sales or commercial thinning proposals on National Forest System land would follow survey and consultation procedures outlined in the 2002 PA. Since portions of the potential commercial thinning stands (harvested in the 1940s) on Tuxekan Island are in the beach fringe, they are likely to be rated as having a high potential for heritage sites. A high potential area would require appropriate surveys, consultation, and protection if sites existed.

Scenery

An important component of Southeast Alaska's recreational value is its attractive natural setting. The importance of this aesthetic value is evidenced by increasing tourism.

This section analyzes the visual resources in the Tuxekan Project Area. The following discussion and analysis is based on the Visual Analysis Resource Report (URS 2002d). The objective of this analysis is to determine whether the proposed harvest units meet the identified visual quality objectives (VQOs). The Forest Service Visual Management System (VMS) provided guidance for the methodology of this analysis (USDA FS 1974). The VMS methodology was used for determining VQOs, visual absorption capability (VAC), the existing visual condition (EVC), and evaluating potential impacts to scenic quality resulting from proposed timber harvesting activities in the project area. The Forest Plan (USDA FS 1997a) designates visual resource management goals (VQOs) that are based on land use designations (LUDs) and distances from which people view the landscape. The Forest Plan adopts the Retention VQO for all areas within the Old Growth Habitat LUD. The VQOs for the remainder of the Tuxekan Project include Modification and Maximum Modification of the landscape. They provide a baseline for measuring changes in visual resources resulting from management activities. The Forest Plan also designates priority travel routes and use areas from which to analyze impacts to scenic resources.

Scenery Affected Environment

Land Use Designations

Old-growth Habitat designations are found in four portions of the project area. The rest of the project area is designated as Timber Production.

Visual Character

The quality of the scenic environment can be categorized in terms of visual character and variety class. The visual character of the Tuxekan Project Area is referred to as the Kuprean of Lowland character type. For the most part, landforms in the project area are rounded. The highest elevation on the island is 1,010 feet above sea level. Shorelines tend to be rocky, but other rock forms are isolated and visually insignificant. Stream forms vary and include pools, meanders, and falls. Although not typical to this character type, much of the island is underlain by limestone, and sinkholes are prominent. In some of these limestone areas, streams go underground. The analysis area is covered with Sitka spruce and hemlock forest, except for numerous scattered muskegs.

Variety Classes

Variety classes are a measure of visual quality in which visual diversity has the highest scenic value. The landscape within the Tuxekan Project Area falls into Variety Class B (common). The landforms in the project area include rolling hills rather than sharp, exposed ridges. Rock outcrops are obvious but do not stand out. Vegetation is generally continuous, with interspersed patterns. Lakes in the project area are typically elongated and average 25 acres. Streams such as Karheen Creek and Kugan Point Creek have common meandering and flow characteristics.

Priority Travel Routes and Use Areas

The priority travel routes and use areas for this analysis were identified in the Forest Plan. The routes and use areas include the following:

- Small Boat Route: Tuxekan Pass to Edna Bay
- Saltwater Use Area: a portion of the West Coast Waterway – El Capitan Pass to Tenass Pass to Karheen Pass

The Tuxekan Pass to Edna Bay small boat route and the portion of the West Coast Waterway together create a marine travelway around Tuxekan Island. These routes are used by boaters and kayakers for recreation and general marine travel. Figure 3-10 shows the viewpoints along these travel routes, and for the use areas below and a comprehensive seen area from all points. Figure 3-11 shows the viewpoints from the waterways and respective seen areas.

- Dispersed Recreation Areas: A) Staney Creek (from recreation site to mouth). B) Mouth of Staney Creek and the cove to the south. There are six dispersed recreation sites total in this area including the Chusini Family Campground.
- Forest Service Recreation Cabin: Staney Creek Cabin

The sites above were identified in the Forest Plan as priority travel routes; however there are no views from these sites to Tuxekan. Therefore, no additional analysis regarding these sites is necessary.

Table 3-101. Seen areas by viewpoint[a]

Viewpoint	Seen Area (acres)	% of Project Area Seen	Not seen (acres)
Tuxekan Narrows	1,594	9	16,136
Scott Lagoon	1,120	6	16,610
Naukati	1,456	8	16,274
Karheen Pass	886	5	16,844
El Capitan	1,104	6	16,626
Tuxekan Pass	1,257	7	16,473
Staney Estuary	1,940	11	15,790

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

[a] Seen areas from some of the viewpoints overlap a seen area from another viewpoint or multiple viewpoints. Therefore, it would not be correct to calculate the total acres seen from this information.

The following sites identified in the Forest Plan will be analyzed as primary viewpoints.

- Staney Creek Estuary
- Community of Naukati

The viewpoints listed in Table 3-101 represent the priority travel routes and use areas listed above.

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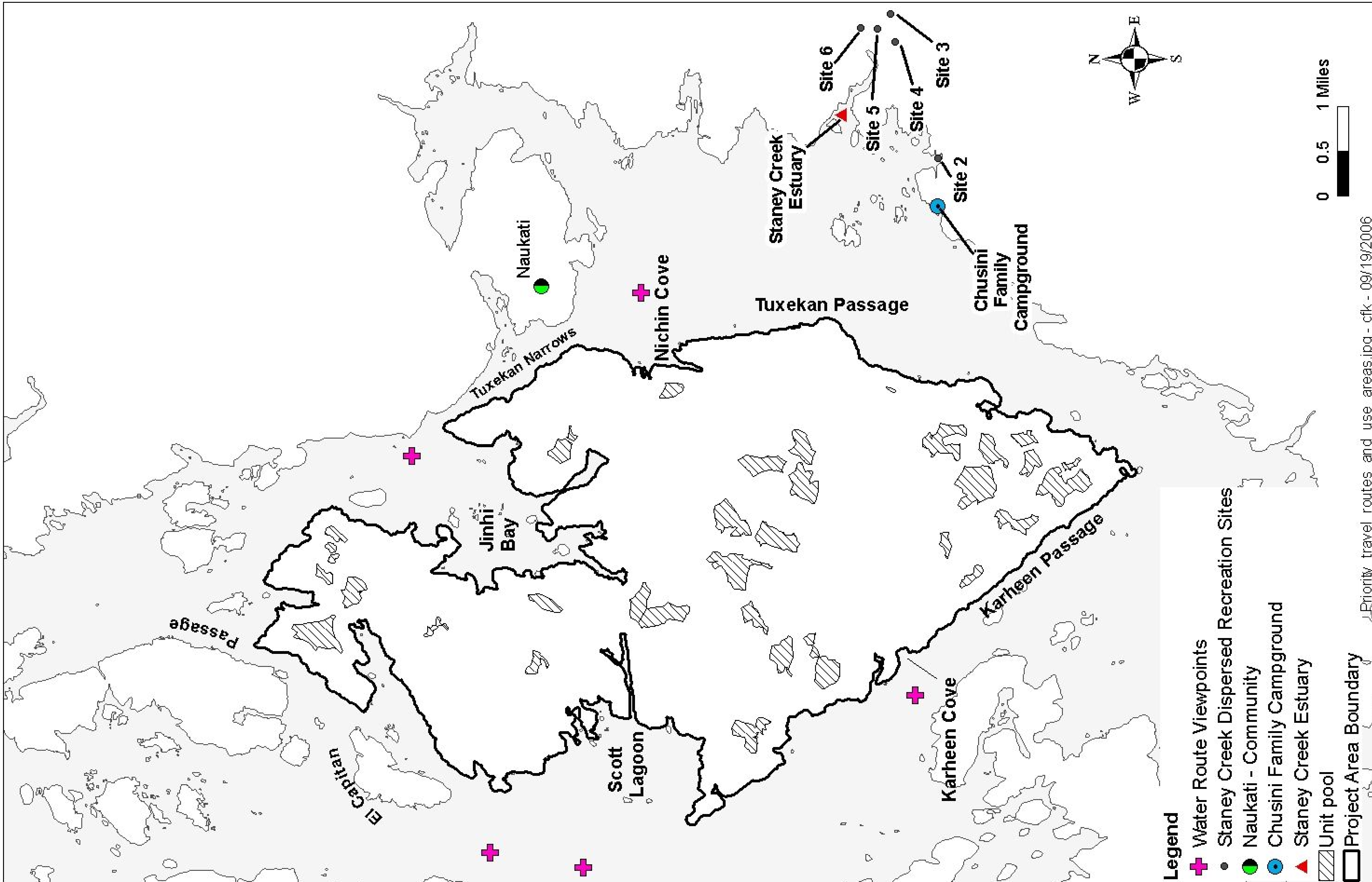

Figure 3-10. Priority travel routes and use areas

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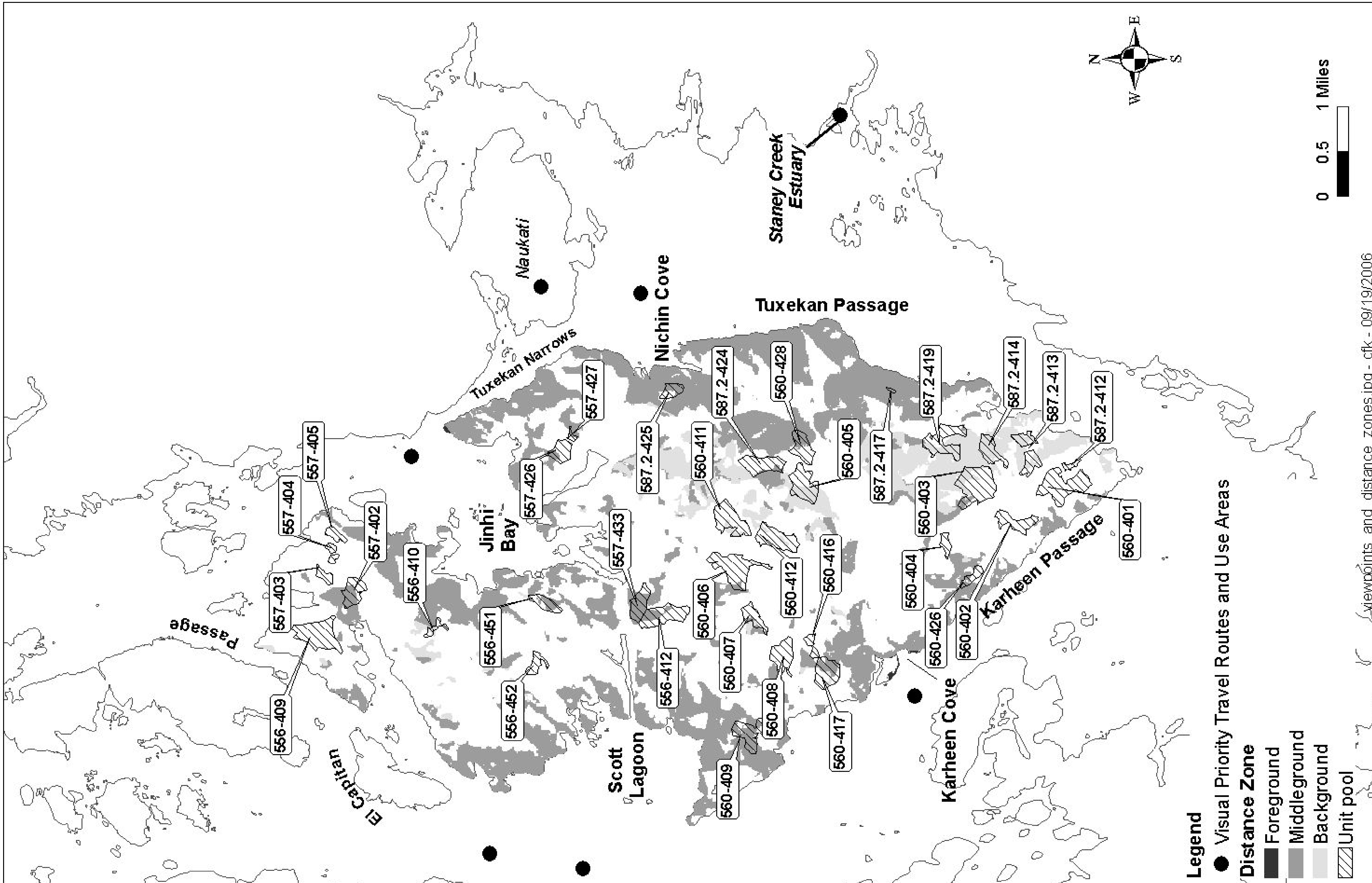

Figure 3-11. Viewpoints and distances

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Visual Quality Objectives and Distance Zones

VQOs are measurable goals for managing scenic forest resources. As adopted in the Forest Plan, VQOs are based on LUDs and distance zones. Distance zones are landscape areas as determined by specified distances from the observer and include foreground (within 0.5 mile of the viewer), middleground (from 0.5 mile to 4 miles from the viewer), and background (from 4 miles to infinity from the viewer). Distance zones from the visual priority routes and use areas listed above include foreground middleground and background for Tuxekan Island. All the proposed harvest units fall within the Timber Production LUD, which has VQOs of Modification (foreground) and Maximum Modification (middleground and background). All areas within the Old Growth Habitat LUD have a VQO of Retention.

- **Retention**: Activities may only repat form, line. Color and texture which are frequently found in the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc., should not be evident.
- **Modification:** Changes in the landscape appear very evident but incorporate natural patterns of form, line, color, and texture when contrasted with the appearance of the surrounding landscape.
- **Maximum Modification:** Changes in the landscape appear highly evident and may visually dominate the surrounding landscape, yet when viewed in the background distance these activities appear as natural occurrences.

Visual Absorption Capacity (VAC)

Visual Absorption Capacity (VAC) is an estimate of the relative ability of a landscape to absorb change resulting from alterations such as timber harvest. Four contributing factors are used in analyzing VAC: slope, distance zone (middleground, and background), landscape complexity (Intermediate), and visibility (seen or unseen). The Forest Plan management prescriptions provide direction in determining the maximum harvest treatment and allowable visual disturbance within development areas utilizing Visual Absorption Capacity classes. The classes are Low, Intermediate, and High, which express a low, intermediate, or high capacity of the landscape to absorb change.

The project area topography has slopes ranging from 20 to 60 percent with very few acres exceeding 72 percent. The landscape complexity can be classified as low to intermediate because of the low vegetative diversity and the relatively common categories of landforms such as rolling hills, muskegs, shorelines, and drainage basins.

Of the proposed harvest units that are visible, most are situated so that they are seen in the background or middleground from the viewpoints identified above.

Existing Visual Condition (EVC)

The EVC characterizes the current state of the landscape, considering previous human alterations. The EVC is measured by condition types described in the Forest Plan.

This portion of the analysis is based on information from the Visual Analysis Resource Report (URS 2002d). When seen from the Tuxekan Passage viewpoint, the project area is characterized as Type V because timber units previously harvested between 1970s and 1990 are numerous and stand out in the landscape. From the Tuxekan Narrows viewpoint, the project area is characterized as Type IV, because timber units previously harvested between

1946 and 1977 are concentrated, and those harvested after 1970 may attract some attention. From the Scott Lagoon viewpoint, the project area is characterized as Type IV, because timber units previously harvested between 1946 and 1992 are concentrated and those harvested from 1970 to 2005 may attract some attention (see Table 3-102).

Allowable Visual Disturbance

Allowable Visual Disturbance expresses how much allowable visual disturbance is acceptable for a given area during any given time period. The proposed management activities for the Tuxekan Project Area may occur adjacent to or near previously harvested locations. Even though individual harvest units may meet a particular Visual Quality Objective, cumulatively a greater impact may result.

Maximum disturbance thresholds modeled during the cumulative effects analyses of the Forest Plan using FORPLAN (Forest Planning Model), are described in Appendix B of the Forest Plan, Final EIS, pages B-17 through B-19. Using this model it was assumed that within the Timber Production Land Use Designation for areas adopting the Maximum Modification Visual Quality Objective that up to 50 percent of suitable lands may be under development at one time.

Previously harvested units within the project area visible from the viewpoints listed above currently comprise approximately 5 percent of the seen area. This quantity is well within the maximum disturbance threshold of 50 percent allowed under the Forest Plan representing a higher degree of scenic quality than expected for timber production areas.

Scenery Direct / Indirect Effects

Scenery Direct / Indirect Effects Common to all Alternatives

The future visual condition of the affected landscape within Tuxekan Project Area is represented by the Timber Production land use designation of the Forest Plan, where the primary goal is to manage land for the sustained long-term yield of wood. The visual effects of this landscape will reflect a higher degree of visibility of the development associated with timber harvest than that characteristic of a natural appearing forest environment. Several factors contribute to the magnitude of visual impact associated with these activities and include: the location from where development is visible, the distance at which it is observed, the vegetative composition of the surrounding landscape, and the design outcome of the activity.

Each of the action alternatives of the analysis will result in varying degrees of change to the visual appearance of the landscape. Green tree retention within each of the harvest units and corresponding shape will further reduce the overall visual effect. Impacts to scenery will remain relatively constant over time as areas of past harvest regenerate and new stands are removed. All action alternatives will achieve a higher level of visual quality than the Adopted Visual Quality Objective of Maximum Modification for the project area.

Scenery Direct / Indirect Effects Specific to Alternative 1

There would be no effects to the scenery resource from Alternative 1.The existing visual character would be maintained. Units previously harvested on Tuxekan Island would mature creating a more natural appearing landscape.

Scenery Direct / Indirect Effects Common to Alternatives 2, 3, 4 and 5

The portions of the proposed harvest units that are visible are seen in the background or middleground from the water or local use areas. Combined with the other VAC factors identified above, the project area can be classified as having an intermediate VAC. No harvest units are planned in the foreground views from the waterway viewpoints. Table 3-102 illustrates the visibility of the proposed harvest acres by alternative.

Table 3-102. Visibility of proposed harvest acres by alternative

Viewpoint	Acres of Proposed Harvest Seen by Alternative in Middleground and Background			
	Alt 2	Alt 3	Alt 4	Alt 5
Tuxekan Narrows	5	6	5	2
Scott Lagoon	3	20	18	19
Naukati	15	15	5	15
Karheen Pass	6	29	12	29
El Capitan	10	36	30	36
Tuxekan Pass	9	10	10	10
Staney Estuary	57	60	40	57
Total Acres Seen by Alternative	**105**	**176**	**89**	**168**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

The amount of acres of proposed harvesting seen in the project area is five percent of the total area that is seen.

Scenery Cumulative Effects

Surrounding waterways of Tuxekan Island including Tuxekan Narrows, Tuxekan Pass – Edna Bay and the El Capitan Pass to Tenass Pass to Karheen Pass portion of the West Coast Waterway, east to the community of Naukati, and southeast to the Staney Creek and mouth of Staney Creek Dispersed and Developed Recreation Areas provides the limits or extents of the analysis area under consideration for cumulative effects to scenic resources. The timeframe for analysis includes timber harvesting from approximately the last 30 years and current planned management actions based on the Forest Plan standard and guideline for maximum allowable disturbance at one time (see Scenery section above). It could take seven years to complete harvesting in this project. Therefore, the maximum amount of disturbance would occur in year 2012. For this analysis, the 30-year time period is 1982 to 2012.

Under the Maximum Modification VQO, up to 50 percent allowable visual disturbance may be absorbed within a viewshed. The proposed harvest units fall within the middleground and background distance zone from the established viewpoints. Therefore, the Maximum Modification Visual Quality Objective applies to these areas.

Table 3-103. Percent allowable visual disturbance (maximum disturbance threshold)

Land Use Designation	Visual Quality Objective	Low VAC (%)	Intermediate VAC (%)	High VAC (%)
Timber Production	Modification	15	20	25
	Maximum Modification	50	50	50

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

The proposed harvesting on Tuxekan Island may occur in units that are adjacent to existing harvest units. As discussed above, the term "percent allowable disturbance" is a Forest Plan criterion that addresses the percent of land within a viewshed (VCU) that is classified as disturbed. Adjacency refers to the amount of time required before a harvest unit can be placed immediately next to an existing harvest unit, sometimes referred to as the green-up period. As a result, even though harvest units may individually meet the VQOs for an area, collectively they may disturb too much of the natural landscape during one period of time. The potential for visual impact is greatest during the first year following timber harvesting. Five years after harvesting, the tree seedlings and understory vegetation would be established. From five to 20 years after harvesting, young trees would reach a height of approximately 15 feet. After 50 years, the stand would reach a height of approximately 50 feet. If seen in the middleground and background, this stand would be almost half the height of existing mature trees and provide a smooth visual transition at the edge of the harvest unit. After 80 years, the trees would be about 75 percent of their mature height. The canopy would be full and closed, blocking sunlight from the forest floor and understory vegetation would decrease. At 100 years, the trees would reach approximately 100 feet and there would be little difference between the stand and the adjacent over-mature forest.

There are no known potential activities known at this time for Tuxekan Island within the reasonably foreseeable future (Tongass SOPA, 2005) that would add to the cumulative impacts of the alternatives.

Table 3-104 outlines the past timber harvesting activities on Tuxekan Island visible from the viewpoints representing the visual priority routes and use areas.

Table 3-104. Acres of past harvest seen by viewpoint[a]

Viewpoint	Past Harvest Seen in the 0-30 year age class	% of Area Seen from Viewpoint of Past Harvest	Acres of Proposed Harvest Seen by Alternative			
			Alt 2	Alt 3	Alt 4	Alt 5
Tuxekan Narrows	51	3	5	6	5	2
Scott Lagoon	49	4	3	20	18	19
Naukati	105	7	15	15	5	15
Karheen Pass	43	5	6	29	12	29
El Capitan	61	6	10	36	30	36
Tuxekan Pass	81	6	9	10	10	10
Staney Estuary	128	7	57	60	40	57
Total Acres of Proposed Harvest Seen by Alternative			**105**	**176**	**120**	**168**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

[a] Seen areas from some of the viewpoints overlap a seen area from another viewpoint or multiple viewpoints. Therefore, it would not be correct to calculate the total acres of past harvest seen from this information.

Table 3-105. Percent of total visual disturbance by viewpoint and alternative

Viewpoint	% of Past Harvest Area Seen by Viewpoint	% of Acres of Proposed Harvest Seen by Alternative			
		Alt 2	Alt 3	Alt 4	Alt 5
Tuxekan Narrows	3	<1	<1	<1	<1
Scott Lagoon	4	<1	2	2	2
Naukati	7	1	1	1	<1
Karheen Pass	5	<1	3	1	3
El Capitan	6	<1	3	3	3
Tuxekan Pass	6	<1	<1	<1	<1
Staney Estuary	7	3	1	2	3

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

All the action alternatives meet the 50 percent total visual disturbance cumulative effects requirement per viewshed established in the Forest Plan, and the Maximum Modification VQO.

Recreation

Recreation General Affected Environment

The Tongass offers many recreation opportunities to both tourists and residents of Southeast Alaska. The following discussion and analysis is based on and summarized from the Recreation Resource Report (URS 2002f). The Tongass recreation and roadless area resources are discussed in considerable detail in the Forest Plan FEIS, Chapters 3 and 4 (USDA FS 1997b).

General Cumulative Effects

Tuxekan Island provides the limits or extents of the analysis area under consideration for cumulative effects to recreation resources. The timeframe for analysis includes timber harvesting from approximately the last 30 years and current planned management actions based on the Forest Plan standard and guideline for maximum allowable disturbance at one time (see Scenery section above). It could take seven years to complete harvesting in this project. Therefore, the maximum amount of disturbance would occur in year 2012. For this analysis, the 30-year time period is 1982 to 2012. Refer to Table 3-105 in the scenery section for the percent of total visual disturbance.

The timeframe for effects to the hunter user group (displacement) extends for 150 years from the start of harvesting due to the length of time associated with the stem exclusion stage for young forests (see Chapter 3 - Sitka Blacktailed Deer). There are no current or planned management activities underway or disclosed in the Tongass SOPA that could affect any recreation resources on Tuxekan Island at present or in the reasonably foreseeable future. The past management activities that create a combined effect with the proposed Tuxekan project

relate to the recreation setting, hunter displacement, and harvesting in the small unroaded areas.

Access

For detailed discussion of access on Tuxekan Island, refer to *Chapter 3, Other Resources, Transportation Management*.

Access Affected Environment

Access to Tuxekan Island is limited and is by a personal or chartered boat or by plane. Tourists and residents of nearby communities primarily gain access to the Tuxekan Analysis Area from Naukati, on Prince of Wales Island. A marine access facility (MAF) (used as during timber harvesting), seaplane base, and old Forest Service dock are located in Nichin Cove that is also used as an anchorage and access point for visitors to the island. Many of the roads on the island are currently impassable to licensed highway vehicles (car or truck). People enjoy hunting, fishing, and riding off-highway vehicles (OHVs) on Tuxekan Island. Residents nearby and visitors transport all-terrain vehicles and motorbikes by boat to access the road system.

See the section on changes to the ROS classes below for additional information regarding access within Tuxekan Island.

Access Direct / Indirect Effects

Access Direct / Indirect Effects Specific to Alternative 1- No Action

There would be no direct or indirect effects to access under the No Action Alternative. Current recreation patterns would continue.

Access Direct / Indirect Effects Common to Alternatives 2, 3, 4 and 5

Proposed timber harvesting from any of the action alternatives would affect existing access sites for recreation opportunities on Tuxekan Island at Nichin Cove where people are most likely to be loading and off-loading OHV at the MAF. When barges are being loaded and moved into and out of the MAF at Nichin Cove, people wishing to enter and exit the Island from that anchorage would be temporarily displaced.

While timber harvesting occurs, and before the roads are put into storage, short-term increases in the access could occur on the Island. Many of the roads that are currently impassable to a licensed highway vehicle will become open to general use following road maintenance and construction. Therefore, access across the Island will become easier for a wider range of recreation users.

The long-term proposal in all of the action alternatives is to put most of the “interior” roads into storage and to decommission several “spur” roads, resulting in less motorized access than in the existing condition. See Figure 2-7. The two major north and south access routes, FR 1460 and FR 1470, would remain open. However, most of the roads “feeding” into the main routes would be put into storage. Therefore, over the long term, there would be less motorized access across the Island.

The proposed timber harvest in any of the action alternatives would affect existing access to recreation opportunities on Tuxekan Island primarily at the MAF at Nichin Cove due to a temporary inability to use docking points during log transfers.

Access Cumulative Effects

There are no past or future actions identified that might affect access to Tuxekan Island.

Recreation Opportunity Spectrum (ROS)

ROS Affected Environment

The Forest Service uses the Recreation Opportunity Spectrum (ROS) to describe, identify, and quantify recreation settings. The ROS categorizes areas by their activities, remoteness, access, and experiences into a spectrum of classes from Primitive to Urban. The Tuxekan Analysis Area has two of the seven ROS classes: Semi-Primitive Motorized and Roaded Modified (Figure 3-12).

The Tongass completed a re-inventory of the ROS classes in 2005. The results of the inventory and analysis led to a change in the ROS classes on Tuxekan Island from the inventory used to develop the DEIS. There are now only two ROS classes that apply to Tuxekan Island, Roaded Modified and Semi-Primitive Motorized.

The Forest Plan direction for recreation places is to maintain the existing ROS class. When approved activities nearby may result in a change to the ROS class, the impacts should be minimized so that a Roaded Modified or other more natural ROS class is maintained. The two northwestern bay recreation places, totaling about 741 acres, fall within a Semi-primitive Motorized and the Roaded Modified ROS class; with about half, 371 acres, in the Semi-primitive Motorized ROS class; and the other half, 370 acres, in the Roaded Modified ROS class. The recreation place at Scott Lagoon, totaling 578 acres, falls within the Roaded Modified ROS class; while the recreation place at Jinhi Bay, composed of 215 acres, falls entirely in the Semi-primitive Motorized ROS class. The recreation place at Nichin cove, with a total of 229 acres, falls in both the Semi-primitive Motorized and Roaded Modified ROS classes, with 31 acres in Semi-primitive Motorized ROS class and 198 acres in the Roaded Modified ROS class. The following map shows the identified recreation places on Tuxekan Island.

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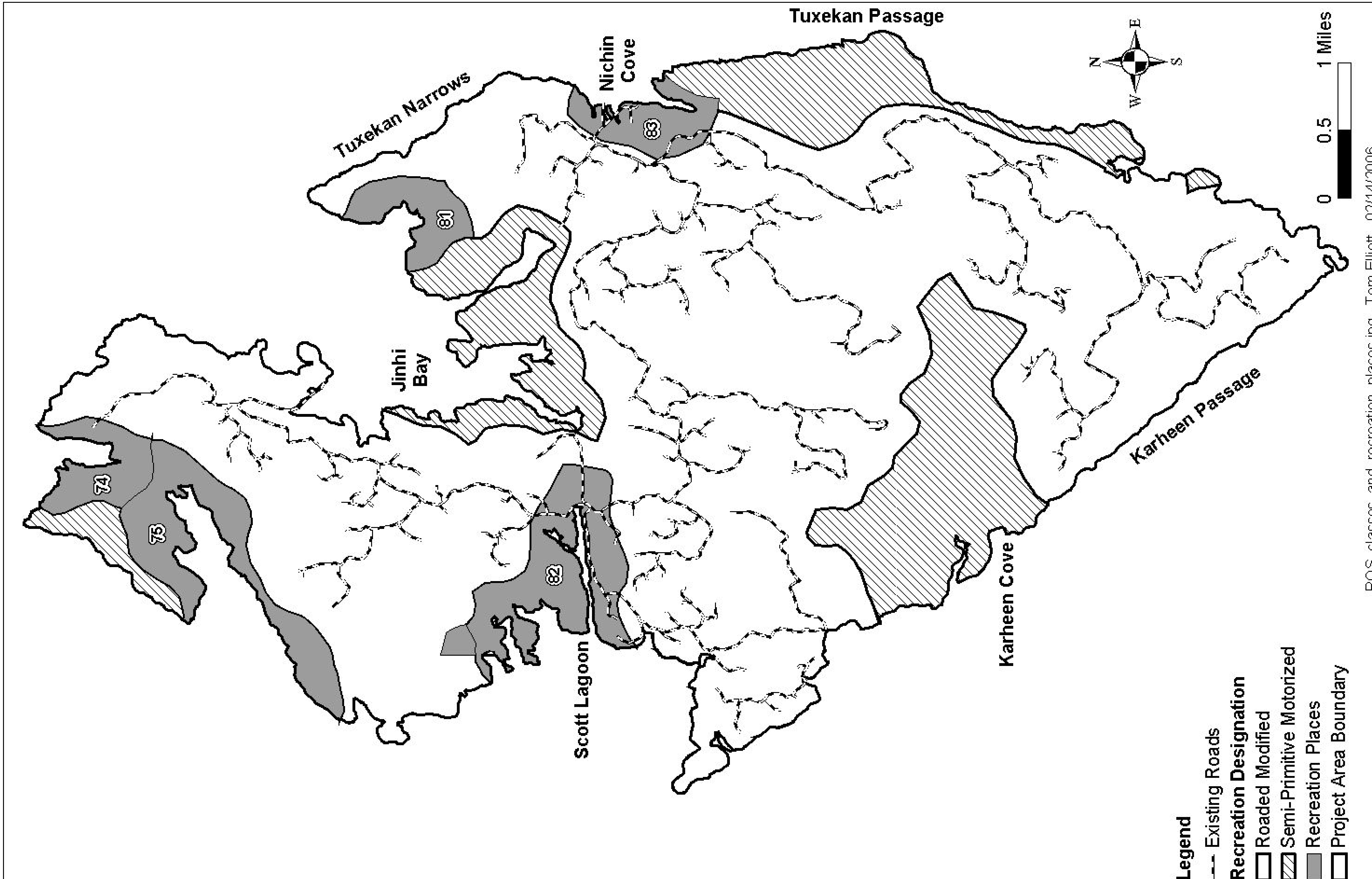

Figure 3-12. Recreation Opportunity Spectrum classes and recreation places

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ROS Direct / Indirect Effects

ROS Direct / Indirect Effects Specific to Alternative 1 - No Action

People would continue to experience the current Semi-Primitive Motorized and Roaded Modified environment of Tuxekan Island under the No Action Alternative.

ROS Direct / Indirect Effects Common to Alternatives 2, 3, 4 and 5

In all of the action alternatives, the effects to the ROS factors (Forest Plan pp. 7-32 to 7-33) of recreation setting, management controls and ability to experience challenge and risk vary only slightly. The Modification and Maximum Modification Visual Quality Objective would be met in all the alternatives, and, therefore, the effects to the current recreation setting from the management activities meet Forest Plan Standards and Guidelines. (See the Scenery section of Chapter 3 for additional information). There are no proposed changes to management controls between alternatives - road signs will continue to be the most obvious feature. The opportunity to experience challenge and risk may increase over the long term as overall road densities decrease and the overall access for recreationists will be limited to people with the ability to hike.

During the years when timber is being harvested, there would be a short-term increase in access across the island for a wider range of recreation users than currently exists. With easier motorized access, the number of social encounters may also increase on Tuxekan Island, but would not change the existing ROS classes.

In summary, the effects to the ROS factors vary only slightly between all the action alternatives. The Visual Quality Objectives will be met. Some short-term increases in motorized access and social encounters may occur during the timber harvesting period. However, once the proposed access plan is implemented, there will be less long-term motorized access, and the area would return into a more natural setting. These effects are consistent with the Roaded Modified and Semi-primitive Motorized ROS classes for Tuxekan Island.

ROS Cumulative Effects

ROS Cumulative Effects Specific to Alternative 1 – No Action

There would be no cumulative effect to Access under the No Action Alternative

ROS Cumulative Effects Common to Alternatives 2, 3, 4 and 5

Within approximately the last 30 years, harvesting within the Island viewpoints, which, in addition to the proposed harvest activities in all the action alternatives (41-acre maximum, or 4.5 percent, increase in Alternatives 2 and 3), create less than the 50 percent allowable disturbance figure adopted for the visual quality objective and therefore meets the recreation setting requirements for the Roaded Modified and Semi-Primitive ROS classes.

Recreation Sites and Places

Recreation Sites and Places Affected Environment

Recreation sites are the specific sites and/or facilities within a recreation place where recreation activities are localized. Recreation sites include, but are not limited to, anchorages, trails, picnic sites, campsites, interpretive sites, Forest Service cabins, and significant natural features like waterfalls or geologic formations that are destinations for National Forest visitors. There are no inventoried Recreation sites in the Tuxekan Analysis Area, therefore no further analysis is needed on inventoried recreation sites.

There are no commercial outfitters and special recreational use permits for the National Forest system lands on record with the Thorne Bay Ranger District. However, lodging, charters, and outfitter/guide companies, which make use of the waters off Tuxekan Island, are available in the nearby communities of Naukati, El Capitan, Craig, and Klawock.

Recreation places are specific areas identified in the Forest Plan that are used for recreation activities. These are identified by inventory number(s) in parenthesis. Inventoried recreation places on Tuxekan Island include:

- Inventoried recreation places for canoeing and kayaking (74 and 75) are two northwestern bays adjacent to Cap Island and Shikat Point, with about half in the Semi Primitive ROS Class and the other half in Roaded Modified ROS Class.
- Inventoried recreation place for dispersed camping (82) is a western area adjacent to Scott Lagoon in the Roaded Modified ROS Class.
- Inventoried recreation place canoeing and kayaking (83) is an eastern area adjacent to Nichin Cove Point The west side of the recreation place is in the Roaded Modified ROS Class, and the east side is in Semi-Primitive Motorized ROS class.
- Inventoried recreation place canoeing and kayaking (81) is a cove on the northeast side of Jinhi Bay in Semi-primitive Motorized ROS Class.

Forest Plan direction for recreation places is to seek to maintain the existing ROS class. When approved activities nearby may result in a change to the ROS class impacts should be minimized so that a Roaded Modified or other more natural ROS class is maintained. Figure 3-12 shows the identified recreation places on Tuxekan Island.

Recreation Places Direct / Indirect Effects

Recreation Places Direct / Indirect Specific to Alternative 1 - No Action

Under the No Action alternative, no effects would occur to the recreation sites or places or the recreating public using them.

Recreation Places Direct / Indirect Common to Alternatives 2, 3, 4 and 5

All the action alternatives include several proposed harvest units in the designated recreation places. See Figure 3-12. Recreation Opportunity Spectrum classes and recreation places.

Within the recreation places listed, effects from timber harvesting include noise from logging activity and truck traffic, visible changes to the closed canopy forested appearance, and a temporary increase in motorized access. The recreation places along the coastline are

protected from regeneration harvesting by a 1,000-foot beach and estuary fringe dictated by the Forest Plan. From the water, the beach and estuary buffer would lessen the noise from logging activities. Direct and indirect effects to ROS are described above.

Table 3-106 illustrates the area affected in each recreation place by showing the proposed harvest acres by alternative.

Table 3-106. Proposed harvest acres by alternative in recreation places

Recreation Place	Acres of Proposed Harvest by Alternative in Recreation Places			
	Alt 2	Alt 3	Alt 4	Alt 5
74 – Northwest Bay by Shikat Point	19	19	19	19
75 – Northwest Bay by Cap Island	15	15	15	15
81 – Jinhi Bay	2	2	2	2
82 – Scott Lagoon	0	1	1	1
83 – Nichen Cove	10	10	10	10
Total Acres in Recreation Place by Alternative	**46**	**47**	**47**	**47**

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

Recreation Sites and Places Cumulative Effects

Recreation Sites and Places Cumulative Specific to Alternative 1 – No Action

There would be no cumulative effect to Access under the No Action Alternative.

Recreation Sites and Places Cumulative Common to Alternatives 2, 3, 4 and 5

The past harvesting activities in addition to harvesting planned in the Tuxekan project area would not result in a change to the ROS setting for the recreation places

Primary Recreation User Groups

Primary Recreation User Groups Affected Environment Primary

People enjoy hunting, fishing, and riding off-highway vehicles (OHVs) on Tuxekan Island. Nearby residents and visitors transport all-terrain vehicles and motorbikes by boat to access the road system. There are approximately 58.8 miles of existing roads on National Forest System lands and 1.7 miles of roads on state land on the island. Approximately 36.6 miles of the roads on National Forest System lands are currently open to high-clearance and off-highway vehicles.

The primary recreational fishing areas on Tuxekan Island are located in Nichin Cove, Karheen Cove, the lower portion of Karheen Creek, the three Karheen lakes, and Kugan Point Lake. Local residents are also believed to harvest clams and other shellfish in Scott Lagoon, Jinhi Bay, and Guhao Inlet.

Kayakers on the West Coast Waterway enjoy viewing the local scenery and exploring the nearby Native American historic sites around North Naukati and El Capitan Passage. Boaters fish and troll in Sea Otter Sound.

At a national level, hunters, anglers, boaters, and motorized vehicle riders are mostly married men between the ages of 25-54, with at least one child at home. Many of the men that engage in one of the activities also participate in one of the other sports. For example, if a man likes to hunt, he most likely also participates in boating and/or fishing (SRDS, 1999).

The numbers of hunters, anglers, boaters, kayakers, and OHV riders that recreate on Tuxekan Island is not known.

Primary Recreation User Groups Direct / Indirect Effects

Primary Recreation User Groups Direct / Indirect Effects Specific to Alternative 1 - No Action

Under Alternative 1, the current recreation patterns would continue unless acted upon by forces unrelated to the proposed project.

Primary Recreation User Groups Direct / Indirect Effects Common to Alternatives 2, 3, 4 and 5

Hunters, OHV riders, and anglers would be temporarily displaced from proposed harvest units in all the action alternatives, if they are currently using those sites. Roads and streams located near harvest units would be closed to the public during logging activities for public safety. This effect would occur in all the action alternatives, although the potential for displacement would be least in Alternative 4 and greatest in Alternative 3 given proposed harvesting levels.

The long-term proposal in all of the action alternatives is to put most of the “interior” roads into storage and to decommission several “spur” roads. This would result in less than a one percent reduction in total road density across the island in all the action alternatives. See Figure 2-7. The two major north and south access routes, FR 1460 and FR 1470, would remain open; however most of the roads “feeding” into the main routes would be put into storage. Therefore, over the long term, there would be less motorized access across the Island.

The experience of hunters and anglers may also be affected by the visual changes in the forest setting from harvest activities. Their perception is that clearcutting may impact their hunting success on deer and other game species. Research on the Tongass indicate that people who hunt and fish have “worries about . . . long-term deer and fish productivity” where harvesting left only 25 percent of the original stand structure (Birchfield 2003).

Deer hunters using proposed harvesting units in all the action alternatives may also experience displacement over a much longer period of time due to the loss of high value deer habitat. Twenty-five years after timber harvesting has been completed, deer habitat declines until stands reach 120-160 years of age (see Chapter 3 - Sitka Blacktailed Deer). As deer move from the harvested units to areas with better habitat, hunters may also have to change hunting locations to remain successful.

Effects to the recreation experience for kayakers and boaters from the action alternatives would come primarily as changes in the recreation setting, as experienced from the water. People may hear machinery and equipment operating across the water while maneuvering around the Island. Effects would not vary considerably between the action alternatives as harvesting would occur near the water in all of them.

Primary User Groups Cumulative Effects

Primary User Groups Cumulative Effects Specific to Alternative 1 – No Action

There would be no cumulative effect to primary user groups under the No Action Alternative

Primary User Groups Cumulative Effects Common to Alternatives 2, 3, 4 and 5

Cumulative effects to user groups other than hunters relate to the recreation setting and access. All action alternatives meet the Maximum Modification Visual Quality Objective.

As shown in the wildlife section in this chapter, there has been a decline in the number of deer harvested from 2000 to 2003. Research on the specific reasons for the reduction in deer harvested on Tuxekan Island does not exist.

Small Unroaded Areas

Small Unroaded Areas Affected Environment

There are no Roadless Areas located on Tuxekan Island.

The Forest Plan Revision, Supplemental EIS, Roadless Area Evaluation for Wilderness Recommendations (referred to in the following pages as SEIS) increased the number of small (less than 1,000-acre) unroaded areas on Tuxekan Island. There are also areas classified as unroaded areas surrounded by developed areas. The largest of these areas is 712 acres, and the smallest is less than one acre. Together, these small unroaded areas total 3,341 acres. Locations of the small unroaded areas may be found in Figure 3-13 Small Unroaded Areas.

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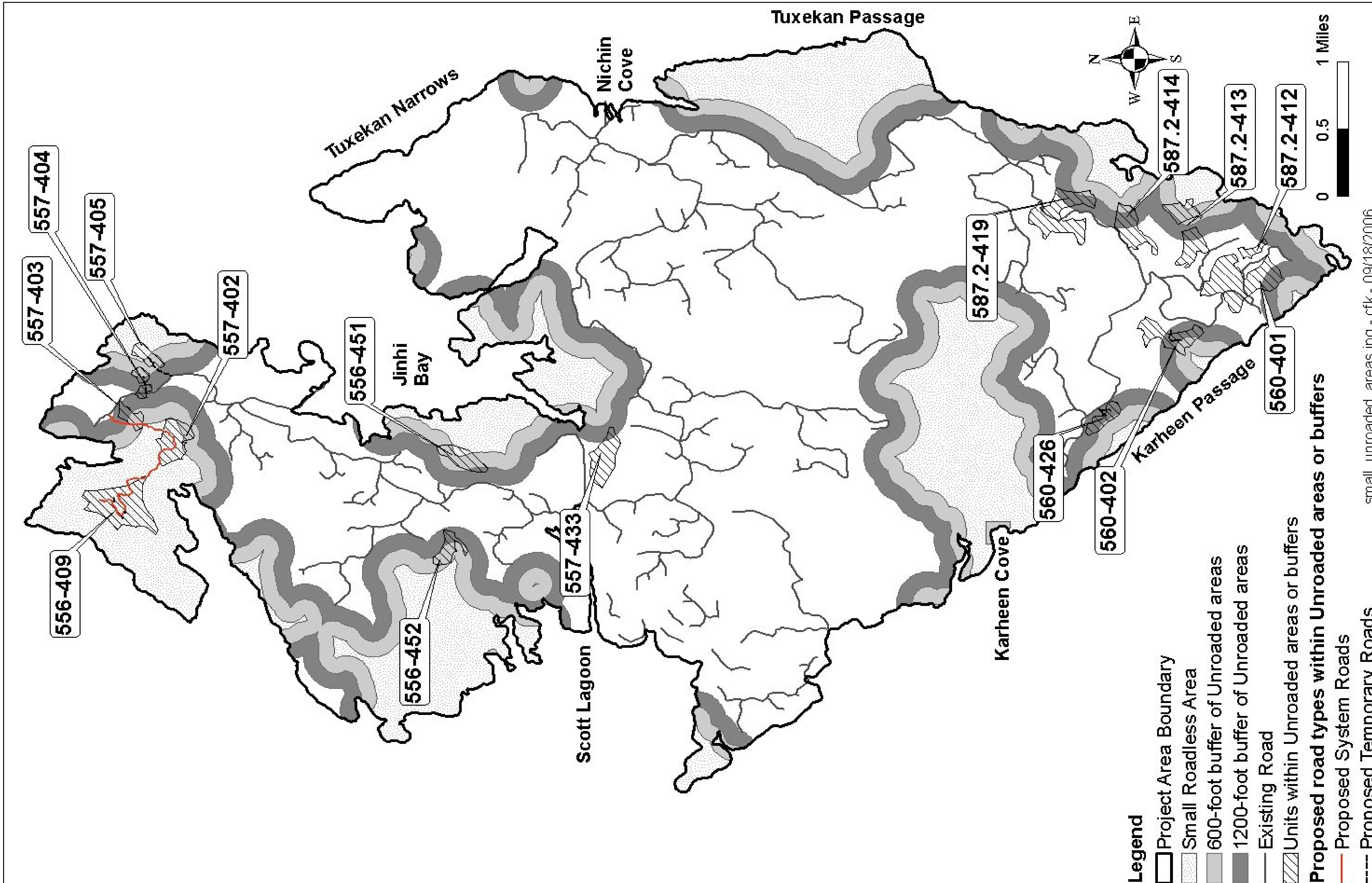

Figure 3-13. Small unroaded areas

These unroaded areas were not classified as single inventoried roadless area, and are not specifically described in the SEIS. These areas are fragmented by past timber harvesting activities. The landscapes of these areas appear natural in the midst of an area designated as a timber LUD These unroaded areas offer a sense of remoteness that provides an opportunity for solitude on Tuxekan Island.

Small Unroaded Areas Direct and Indirect Effects

Small Unroaded Areas Direct and Indirect Effects Specific to Alternative 1 – No Action

Under the No Action alternative, no effects would occur to Small Unroaded Areas

Small Unroaded Areas Direct and Indirect Effects Common to Alternatives 2, 3, 4, and 5

Implementation of Alternative 3 would affect 29 percent of the of the small unroaded areas, resulting in the greatest impact of all the alternatives. Alternative 5 would impact 26 percent of the small unroaded areas followed by Alternative 4 with 22 percent impact and Alternative 2 with the least impact of 20 percent. Refer to Table 3-107. Effects to small unroaded areas by alternative.

Table 3-107. Effects to small unroaded areas by alternative

Alternative	Alt 2	Alt 3	Alt 4	Alt 5
Miles of road within 1200’ of small unroaded area	6.4	9.0	5.9	8.2
Acres of 1200’road buffer overlapping small unroaded areas	284	380	287	333
Acres of 600’ buffer of units that overlap small unroaded areas	375	579	437	544
Total acres of small unroaded areas affected	659	959	724	877
% of small unroaded areas affected	20	29	22	26

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

In the areas that would be affected by the action alternatives, the overall landscape would no longer appear natural. The opportunity for solitude in a remote setting would be decreased. Refer to the wildlife, and heritage environmental consequences for effects to those unroaded area characteristics related to those resources.

Short-term indirect effects include impacts to recreationist from the noise, and dust created by activities associated with timber harvesting.

The Forest Plan does not include areas as unroaded if they are within 600 feet of clearcuts, or within 1,200 feet on either side of a proposed NFS or temporary road.

Small Unroaded Areas Cumulative Effects

The cumulative effects boundary for the small unroaded areas is Tuxekan Island. The timeframe of analysis is from 1982 to 2012.

Small Unroaded Areas Cumulative Effects Specific to Alternative 1- No Action

Under the No Action alternative, past activities have created 15 acres of overlap in a small unroaded area with a road buffer of 1200’. No other activities are planned in the project area.

Small Unroaded Areas Cumulative Effects Common to Alternatives 2, 3, 4, and 5

No future activities are planned on Tuxekan Island that would affect small unroaded areas. Approximately 3,180 acres of past harvesting has occurred in the small unroaded areas creating a mosaic of a variety of age classes in the forest setting. Refer to Table 3-108. Acres of cumulative effects on small unroaded areas by alternative.

Table 3-108. Acres of cumulative effects on small unroaded areas by alternative

Alternative	Acres of cumulative effects to small Unroaded areas
2	3,839
3	4,139
4	3,904
5	4,058

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

Implementation of an action alternative would decrease the opportunities for remoteness and solitude across Tuxekan Island. The natural landscape character would become more fragmented by timber harvesting activities.

Socioeconomics

Southeast Alaska is the social and economic analysis area for direct, indirect, and cumulative impacts of the Tuxekan Project. The livelihood of many area residents is connected with the Tongass through jobs, subsistence activities, and/or recreation and tourism. Mills in Southeast Alaska process most of the timber sold from the Tongass; these mills also employ a number of local residents. The marine areas associated with the Tongass support a commercial fishing industry employing many local residents. Many rural residents of this region harvest fish, wildlife, and various edible plants from the Tongass for subsistence purposes. Southeast Alaskans also account for a high percentage of the recreational visitors who travel annually to the Tongass.

The evaluation of cumulative effects relative to economic impacts for all alternatives focuses on past, present, and reasonably foreseeable activities through 2010. Analysis of this period allows for consideration of impacts from the full implementation of the action alternatives in combination with projected harvests by State and private entities, which were available for 2005 through 2010.

The information and analysis in this report are derived from existing sources of data. Information developed for and presented in the Final Environmental Impact Statement for the

Forest Plan provided a starting point. Additional information was obtained from reports and databases developed by the Alaska Department of Labor, Alaska Department of Commerce, and the U.S. Census Bureau. Where available, community specific data was used. However, in some cases community level data was not available, therefore information at the census area or state level was used as the best available indicator of local conditions.

The economic analysis was conducted using an Excel workbook entitled NEPA Economic Analysis Tool (NEAT). NEAT provides a preliminary appraisal based on the Transaction Evidence appraisal method and is described in more detail under Issue 2, Timber Sale and Local Economics. The value comparison provided can be used only for relative values and not for exact monetary values.

Socioeconomic Affected Environment

The following discussion and analysis tiers to the detailed socioeconomic information and analysis contained in the Socioeconomics Resource Report (URS 2001c) Chapter 3 and Appendix H of the Forest Plan Final EIS (USDA FS 1997b).

Although employment from the utilization of natural resources is an important source of income, government (local, state, and federal) is the largest employer in most towns in the region. In addition, non-wage income from government transfers (Social Security, Medicare, public assistance, etc.) and investment income are major contributors to total income in small communities (Allen et al. 1998).

Within Southeast Alaska, the specific areas most likely to experience social and economic effects from the Tuxekan Project are (1) communities close to the project area, (2) nearby communities whose residents currently visit the project area to hunt, fish, or pursue other subsistence or recreational activities, and (3) nearby communities with production facilities that would use timber from the project area. The largest communities in the immediate vicinity are Naukati on Prince of Wales Island and Edna Bay on Kosciusko Island. No established communities exist on Tuxekan Island. Other communities in the general vicinity of the project area include Cape Pole, Craig, Klawock, Point Baker, Port Protection, Hollis, Hydaburg, Kasaan, Whale Pass, Thorne Bay, and Coffman Cove. Together, these communities comprise the Prince of Wales census subarea. The larger cities of Petersburg, Wrangell, Sitka, and Ketchikan are also located relatively close to the project area. Residents of these communities may visit the project area for hunting, fishing, subsistence, and/or recreational purposes. Communities with production facilities (primarily sawmills) that may use the timber from the project area include Wrangell, Petersburg, Klawock, Craig, Kasaan, Edna Bay, and Ketchikan.

These communities form a significant part of the population and economy of Southeast Alaska. Economic activity in this region is generally reflected in employment levels, personal earnings, and the overall economic well-being of these Southeast Alaska communities. In addition to Southeast Alaska, a secondary social and economic sphere of influence may be considered. This area of influence is not a specific geographic region but encompasses the many industries, employees, and visitors dependent on or affected by the proposed actions in the Tuxekan project area. It includes, in part, the entire state of Alaska; other western states, especially Washington, Oregon, and California; western Canadian provinces, especially British Columbia; and other Pacific Rim countries, particularly Japan. Due to the relatively small harvest volume proposed for the Tuxekan Project in relation to these large market areas, the discussion in this section focuses only on the area of Southeast Alaska. The

majority of the emphasis is placed on the importance of the Tongass to the social and economic environment of the region and, in particular, the region's timber industry.

Population

In 1990, the population of Southeast Alaska was estimated at 57,617 people. By 2000, the population in the region had grown to 73,082. Most communities in Southeast Alaska are small, isolated from each other, and accessible only by air or water. Only four communities in this region are accessible by roads on the mainland: Skagway, Haines, Klukwan in the north, and Hyder in the south. The largest community in Southeast Alaska is Juneau, the state capital. Juneau, with a 2000 population of 30,711, is also the only city in the region with more than 15,000 individuals. Other relatively large communities in the region include Ketchikan (and surrounding areas), with a 2000 population of 14,059, and Sitka, with a population of 8,835. Together, Juneau, Ketchikan, and Sitka contain over 73 percent of the population of Southeast Alaska. The remaining population resides in more than 45 small communities scattered throughout the region. Most of these small communities have populations of less than 1,000 residents.

Between 1960 and 2000, the population of Southeast Alaska grew from 28,423 to 73,082, an increase of almost 157 percent. However, due to the closure of large pulp mills in Sitka and Ketchikan and their related sawmills in Wrangell and Metlakatla during the mid-1990s, population numbers actually dipped in many Southeast Alaska communities in the last decade.

Marginal overall population growth and declines in the Southeast Alaska region over the last decade have been masked by a 16 percent population growth in Juneau, the region's largest urban center. The Wrangell-Petersburg census area experienced a decline of 5.1 percent over the past decade. In the Outer Ketchikan/Prince of Wales census area, the population decreased by 400 residents between 1996 and 2000, a 6 percent decline; this census area experienced a decline of 2.1 percent for the decade. Marginal growth of 2.9 percent was seen in the Sitka Borough census area over the last decade.

The Prince of Wales census subarea contains the communities closest to the proposed project area and had an estimated population of 4,070 in 2004. This represents an average annual decline of approximately 2.8 percent since 2000. The 2004 estimated population for Southeast Alaska of 70,622 represents an average annual decrease of approximately 0.8 percent since 2000 (ADOL, 2005).

Lifestyles

Alaska has always been known for its vast expanse of unique scenery and seemingly limitless natural resources. The quality of life in Southeast Alaska is greatly enhanced by, and in many ways dependent on, the physical environment associated with its unique landscape. The Tongass is an important part of that landscape.

Southeast Alaska residents have a diverse set of lifestyles, values, and economic pursuits. Many people choose to live in Southeast Alaska because of the opportunity to participate in the commercial fishing, timber, mining, and recreation industries. Other residents desire the lifestyles afforded by remote, uncrowded living situations. Still others choose to reside in Southeast Alaska because of the hunting, fishing, recreation, and subsistence opportunities afforded by close proximity to a remote, wild environment. In addition, many Native Alaskan

residents consider Southeast Alaska an important link to the practice of their traditional customs and the preservation of their cultural heritage.

Many residents wish to maintain the unique natural characteristics of Southeast Alaska. However, they also must maintain their economic base. Because of limited resources, maintaining the balance between quality of life and economic security has become increasingly difficult. The diversity of attitudes, beliefs, values, and lifestyles of the residents of Southeast Alaska suggests that the Tuxekan Project would affect individuals both positively and negatively.

Residents of this area are often faced with the disadvantages of seasonal employment, lack of jobs, high cost of imported goods and services, transportation limitations, and weather-related issues. For some, seasonal employment is considered beneficial because of the way it meshes with a subsistence lifestyle.

Community Stability

Maintenance of community stability is an important consideration in the planning of resource management activities in the Tongass. However, community stability in Southeast Alaska is quite difficult to quantify because of the many variables that influence it. Factors such as employment levels, incomes, receipts, or multipliers do not provide the entire picture, particularly with respect to quality of life. Nevertheless, the balance created by having a variety of natural and human-related resource activities is a key component in the maintenance of community stability. This equilibrium is important because it prevents the overexploitation of any one natural resource, thus ensuring the availability of the resources for all the region’s communities.

The careful management of Tongass resources is vital to the social and economic health of the region as a whole. Communities near the Tuxekan Project whose financial situation is tied to logging and related industries include Naukati, Thorne Bay, Coffman Cove, Craig, and Wrangell. These communities could potentially be affected by changes in the supply of timber from the Tongass. Other communities exhibiting primary processing infrastructure for the timber industry include Petersburg, Klawock, and Ketchikan. Resource management activities in the Tongass are of great importance to all communities in Southeast Alaska.

Economy

Community Characteristics

Communities in Southeast Alaska exhibit varying degrees of economic development and diversity. Commercial fishing and fish processing, timber harvesting and processing, recreation, tourism, mining, marine vessel construction and repair, and government are the major economic sectors in which residents are employed. The relative importance of each of these activities in any particular community varies locally. Some communities have little or no economy in the conventional sense and rely heavily on local subsistence uses. In these cases, sources outside the community typically play a major role in supplying goods and services that cannot be obtained locally. Some communities depend heavily on a single economic activity. Other communities have a full range of economic activities, which combine to provide more consistent employment throughout the year.

Personal Income and Employment

Compared to the national average, Alaska has a high proportion of people whose incomes are below the poverty level. The 1999 per capita income statewide was $28,577 and the national average was $29,697, which ranks Alaska 17th among the 50 states. The region's annual employment growth has ranged from 4.6 percent in 1990 to 1.4 percent in 1998. Although per capita income was about 38 percent higher than the national average in 1985, it had decreased to only 6 percent higher than the national average by 2002. Although the average income in Southeast Alaska is slightly above the national average, 88 percent of the region's Native population (approximately 20 percent of the region's population) meets the federal guidelines for low income.

The unemployment rates in the Southeast Alaska region ranged from a low of 4.8 percent in Juneau Borough to a high if 10.1 percent in the Prince of Wales-Outer Ketchikan Census area in June 2005. The statewide rate for the same period was 6.2 percent (Alaska Dept. of Labor 2005).

Across Southeast Alaska, 25 percent of households earned less than $30,000 in 1999. Approximately 15 percent earned over $100,000. However, within the Prince of Wales-Outer Ketchikan Census Area, 35 percent of households earned less than $30,000 and only 7 percent earned $100,000 or more (Sonoran Institute 2005). Within the Prince of Wales-Outer Ketchikan Census area, 10.3 percent of families had income levels below poverty level (US Census Bureau 2005).

Population declines in Southeast Alaska's Native villages are coupled with very low household incomes and employment rates. The percentage of Native households living below the U.S. Health and Human Services poverty level ranges from a low of 20 percent in Kasaan to a high of 77 percent in Angoon. Unemployment rates among Native villagers range from a low of 12.5 percent in Pelican to highs of 54 percent in Angoon and 60 percent in Kasaan, according to the Central Council Tlingit and Haida Indian Tribes of Alaska's 1999 Native Count Census.

Throughout the mid-1990s, curtailed timber harvesting activities resulting from the Tongass Timber Reform Act (1990) and Forest Plan decisions, in combination with an economic crisis in Pacific Rim markets, resulted in significant economic hardships for individuals and communities in Southeast Alaska. Many communities are still recovering from timber industry closures and have been recipients of major state and federal aid projects to assist them through this economic hardship. As discussed later in this section, growth in other industry-sectors has helped to offset some economic decline, although no year-round industry has evolved to offset the overall economic decline. The economic distress that is often endemic to rural communities in the region has not been alleviated by growth in other sectors of the economy. Government transfers listed earlier and investment income provide many households with relatively fixed year around incomes.

The forestry and logging and wood products sectors represented approximately 1.4 percent of all employment in Southeast Alaska in 2003, down from about 5 percent ten year ago. However, forestry and logging and wood products still accounted for 6.7 percent of the employment in the Prince of Wales-Outer Ketchikan Census Area, which includes the communities closest to the project area. Earnings from forestry and logging represented 6.6 percent of earnings in the Prince of Wales-Outer Ketchikan Census Area. Earnings for the

wood products sector were suppressed in order to avoid the release of proprietary information (Alaska Department of Labor and Workforce Development 2004).

Socioeconomic Direct and Indirect Effects

Socioeconomic Direct and Indirect Effects Specific to Alternative 1

Population

The No Action Alternative is not expected to have a noticeable effect on the size, demographic makeup, or growth trends of the Southeast Alaska population. No timber harvest would be conducted to contribute to the maintenance of the timber industry in Southeast Alaska, however, no measurable adverse impact to populations would be likely.

Lifestyles and Community Stability

Timber sale projects have historically had a variety of positive and negative effects on local communities. Communities dependent on the timber industry would view the No Action Alternative as an adverse impact to a troubled industry that is important to their way of life. To other communities more dependent on subsistence gathering, Alternative 1 is more likely to be viewed as beneficial to the maintenance of the day-to-day lives of residents. Those who prefer a more natural appearing environment or who favor a transition to a tourism-based economy would view Alternative 1 as most beneficial.

Economics

Net revenue (expected bid value less projects costs) is estimated to be -$828,927 under Alternative 1. The financial efficiency of all alternatives is discussed in more detail under Issue 2, Timber Sale and Local Economics.

Income and Employment

Commercial Fishing Industry. The No Action Alternative is expected to have no adverse effect on the commercial fishing industry of Southeast Alaska as no fish habitat would be impacted by management activities associated with this project.

Recreation and Tourism Industry. The recreation and tourism industries in Southeast Alaska would be expected to experience no adverse effects as a result of implementation of the No Action alternative. The volume of recreation and tourism activity in the project area would be unaffected.

Timber Industry. Alternative 1 would not contribute support for jobs or income in the timber industry. Small businesses that are economically dependent on timber uses would continue to request increased harvesting opportunities.

Civil Rights Impact Analysis

A Civil Rights Impact Analysis (CRIA) is used to identify any possible impact associated with a proposed project based upon an individual's civil rights (religion, race, color, national origin, age, gender, disability, marital status, and political beliefs). There has been no

indication, nor comments suggesting that the No Action Alternative would impact any individual's civil rights.

Environmental Justice

Executive Order 12898 requires the evaluation of alternatives to determine whether they would disproportionately impact minority or low income populations. Although no jobs or income would be generated under the No Action Alternative, no disproportionate effects to minority or low income groups have been identified. Additionally, subsistence uses would not be adversely impacted. Therefore, no disproportionate adverse effects on minority or low income groups are anticipated under the No Action Alternative.

Socioeconomic Direct and Indirect Effects Common to Alternatives 2, 3, 4 and 5

Population

None of the action alternatives are expected to have a notable effect on the size, demographic makeup, or growth trends of the Southeast Alaska population. This is due in part to the fact that the size of the harvest would be modest and would contribute to maintaining the existing timber industry in Southeast Alaska.

Lifestyles and Community Stability

To communities dependent on the timber industry, the action alternatives may be seen as beneficial to their way of life, helping to guarantee the continued employment of residents. To communities that are more dependent on subsistence gathering, implementation of these alternatives may serve to hinder activities that are important to the day-to-day lives of residents. Those who prefer a more natural appearing environment or favor a transition to a tourism based economy would likely view impacts from these alternatives as detrimental.

Economics

The analysis of economic effects considers both market-related values in the form of jobs, income, and financial efficiency and non-market values such as other opportunities, resources, and services afforded by the area. Commenters expressed concern that the negative effects to non-market or amenity values may exceed the value of the timber to be removed. Non-market values by their nature are difficult to quantify. No widely accepted method by which to translate non-market values into dollar figures has yet been devised and accepted for use by the Forest Service. Direction provided in Forest Service Handbook 1909.15, 15 (7/6/04) and 22.35 (01/14/05) and 40 CFR 1502.23 provides for the use of qualitative analysis to evaluate the effects of these non-market values.

Financial Efficiency

The analysis of financial efficiency is a comparison of those costs and benefits that can be quantified in terms of actual dollars spent or received within the project area. A financial efficiency analysis offers a consistent measure in dollars for comparison of alternatives. It should not, however, be viewed as a complete answer, but only as a tool that the responsible official can use to compare alternatives and the trade-offs between costs and benefits.

The total estimated budget costs (including environmental analysis, sale preparation, sale administration, and engineering support) for the financial cost analysis of all the alternatives are displayed in Table 3-36.

Net revenue (expected bid value [Table 3-42] less project costs [Table 3-43]) is negative for all action alternatives as summarized in Table 3-109. Among the action alternatives, project costs under Alternative 4 are lowest, however net revenue is highest under Alternative 2. Alternative 5 followed by Alternatives 4 and 3 would provide the lowest net revenue.

Table 3-109. Net revenue by action alternative

	Alt 2	Alt 3	Alt 4	Alt 5
Net Revenue (expected bid value less project costs)	*-1,115,789*	*-1,325,318*	*-1,357,260*	*-1,456,785*

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

Among the action alternatives, project costs under Alternative 4 are lowest, however net revenue is highest under Alternative 2. The lowest net revenue would be provided by Alternative 5 followed by Alternatives 4 and 3. Financial efficiency is discussed in more detail under Issue 2, Timber Sale and Local Economics earlier in this chapter.

Financial efficiency, however, does not account for non-market benefits, opportunity costs, individual values, or other benefits, and costs that are not easily quantifiable. These will be discussed qualitatively under Economic Efficiency below.

Economic Efficiency

Economic efficiency compares cost and benefits of resources, quantifiable or not. Measures that are difficult to quantify include passive use, non-consumptive use, and opportunity costs. Values such as clean water, scenery, quality of life, sense of place, and life styles are also important considerations. Many of these benefits do not have established market values and can be difficult to quantify. Often an amenity impact that is perceived as a cost to some may be viewed as a benefit by others. The discussion of these values is, therefore, qualitative in nature and is discussed at the local/regional scale. The 1997 Forest Plan addressed and balanced resource values and uses at the larger scale. Rather than ranking alternatives, this portion of the analysis is meant to highlight resource uses and concerns in the project area and differences between alternatives.

Under the action alternatives, the direct impact caused by logging activities such as logging traffic and noise may cause those accustomed to recreating in the area to temporarily relocate to other locations until harvesting activities are completed. The indirect, long-term effects of vegetation changes may cause some recreationists to permanently relocate to other areas. Traditional use by hunters may be impacted as a result of wildlife use patterns that are altered by harvesting activities in the short-term and by vegetative changes in the long term.

Subsistence uses are an important part of life for many residents of Southeast Alaska. Some families rely on subsistence activities for their cultural or rural lifestyle. The primary subsistence use in the project area is deer harvesting. The effects of the alternatives to subsistence use of deer are discussed in more detail under the discussion of Subsistence under Issue 3 in this chapter.

Business owners who are dependent on the timber industry will likely view the proposed project as having a positive effect, helping to maintain their economic viability as well as lifestyle and quality of life. Others view harvesting activities as both a short- and long-term disruption to a lifestyle developed around the wild and undeveloped Alaska landscape that attracts many residents and visitors. For these individuals, quality of life would be adversely affected by timber harvesting. Those seeking a wild, undeveloped Alaskan experience may view scenery changes that result from harvesting negatively. However, others may view openings in the vegetation created through harvesting as enhancing scenery and increasing opportunities for viewing wildlife.

Those who value knowing that wild, undeveloped forest areas exist would likely view the proposed harvest activities as a negative impact to a resource they value and consider to be rare. Others place a high value of the use of natural resources for the benefit of humankind and would likely support harvest activities as a prudent use of a renewable resource.

Income and Employment

Commercial Fishing Industry. Alternatives 2, 3, 4, and 5 are expected to have little or no adverse effect on the commercial fishing industry of Southeast Alaska. Under all of the action alternatives, some fish habitat may be affected due to stream and watershed alterations resulting from road construction and logging activities. The effect of this habitat alteration on the regional commercial fishing industry is expected to be very low. Impacts to habitat would be minimized by the use of site-specific mitigation measures described in the Fisheries section of this chapter and on the Unit Cards displayed in Appendix B.

Recreation and Tourism Industry. The recreation and tourism industries in Southeast Alaska would be expected to experience few or no adverse effects as a result of implementation of any of the action alternatives. The visual experience obtained by recreationists traveling past the project area by air and by water may be diminished slightly due to the presence of forest management operations. The small amount of recreation and tourism in the project area should be unaffected by the project.

Timber Industry. Over 57 percent of the 2003 estimated statewide employment in the Alaskan timber industry was is in the southeast region of the state. The Southeast Alaska timber and wood products industry is composed of multiple logging operations on both public and private lands. Cut logs may be processed in larger sawmills and numerous smaller sawmills scattered throughout the region. Products manufactured include dimension lumber, cants and flitches (rough-sawn lumber meeting primary manufacturing requirements), wood chips, and raw logs.

Fluctuating levels of employment and product values indicate that the Southeast Alaska timber industry is a volatile entity. A combination of weak Asian markets, closure of the pulp mills (which provided a market for low-grade timber), and steadily declining and unpredictable timber supply has pushed the Tongass National Forest harvest to its lowest levels in more than 30 years. The total 2003 Tongass National Forest timber harvest level was 51.3 MMBF and 46.4 MMBF in 2004, less than 11 and 10 percent respectively of the 1990 harvest of 471 MMBF. Employment in the Southeast Alaska timber industry, including harvest of private timber, has declined from approximately 2,550 jobs to about 490 over the same period.

The jobs and income potentially supported through timber harvest activities under each of the action alternative is summarized in Table 3-110. The estimation of the number of jobs and

income is discussed in more detail under Issue 2, Timber Sale and Local Economics earlier in this chapter.

Table 3-110. Jobs and income potentially supported under each action alternative

	Alt 2	Alt 3	Alt 4	Alt 5
Jobs	97	129	79	117
Income	$3,568,496	$4,779,785	$2,927,555	$4,333,073

Source: USDA Forest Service, Thorne Bay Ranger District, GIS Database and analysis

All of the action alternatives would impact the regional supply of and demand for timber by providing several sales to meet local demand.

Payments to States. Prior to 2000, in states with national forests, 25 percent of the returns to the US Treasury from revenue-producing Forest Service activities, such as timber sales, were returned to each state for distribution back to counties (or in Alaska, boroughs) having acreage within a national forest. Those payments were called the "25 Percent Fund payments" and were dedicated by law to roads and schools. In October 2000, the Secure Rural Schools and Community Self Determination Act of 2000 was enacted to stabilize federal payments to states, in response to declining federal receipts.

For fiscal years 2001 through 2006 under the new legislation, Alaska boroughs and communities have elected to receive a full payment amount rather than 25 percent of receipts. The full payment amount is the average of highest three payments made to the state during the 14 year period between 1986 and 1999. These annual full payment amounts would be primarily dedicated to roads and schools, with provisions for special project funding under certain conditions. Under the full payment approach, Forest Service payments to the State of Alaska during the 2001 to 2006 period would not be linked to annual Forest Service revenue, rather they would be based on the high three year historic average. The difference in revenues among the alternatives considered in the Environmental Assessment would have no effect on the payments boroughs receive during the 2001 through 2006 time period. After 2006, unless the Secure Rural Schools and Community Self Determination Act is extended by Congress, 25 percent fund payments will resume.

Civil Rights Impact Analysis

A Civil Rights Impact Analysis (CRIA) is used to identify any possible impact associated with a proposed project based upon an individual’s civil rights (religion, race, color, national origin, age, gender, disability, marital status, and political beliefs). There has been no indication, nor comments suggesting that the proposed project would impact any individual’s civil rights. This conclusion tiers to the Economic and Social Environments Analysis included in Chapter 3 of the 1997 Forest Plan FEIS.

Environmental Justice

Executive Order 12898 directs federal agencies to identify and address the issue of environmental justice, that is, adverse human health and environmental effects of agency programs that disproportionately impact minority and low-income populations. The

Executive Order specifically directs agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife.

Tuxekan has no established communities. The nearby communities of Edna Bay on Kosciusko Island and Naukati on Prince of Wales Island have traditionally used Tuxekan Island and its surrounding waters for subsistence hunting and fishing, commercial fishing, recreation, and noncommercial timber harvest. Prince of Wales Island has several established communities that have also traditionally used Tuxekan Island for subsistence use. These communities include Craig, Klawock, Hollis, Hydaburg, Kasaan, Thorne Bay, Point Baker, Port Protection, Whale Pass, and Coffman Cove. Residents of the small community of Meyers Chuck, situated on the Cleveland Peninsula, have historically hunted on Tuxekan Island, as have residents from the larger communities of Ketchikan, Wrangell, Petersburg, and Sitka.

A majority of Hydaburg and Klawock residents are Alaskan Native, while Kasaan's population is almost equally divided between Alaskan Native and residents identified as white or of two or more races. Other identified Prince of Wales communities have mostly white residents. Project-specific public involvement was conducted through the use of direct mailings, legal notices in newspapers, public meetings, and issuance of draft documents soliciting public comment (see section entitled Public Scoping for this Project in Chapter 1 of this document). No concerns relative to disproportionate impacts to minority or low income populations were raised.

Implementation of the action alternatives will not cause adverse health or environmental effects that disproportionately impact minority and low-income populations.

Socioeconomic Cumulative Effects

As stated earlier, the cumulative effects analysis area for the social and economic effects is Southeast Alaska and focuses on past, present, and reasonably foreseeable activities through 2010.

Southeast Alaska's predominantly Native communities have suffered from a combination of declining Tongass timber harvests and declining Alaska Native Claim Settlement Act (ANCSA) harvests. Collectively, Southeast Alaska communities with a Native population of 60 percent or more have experienced a 5 percent population decline since 1996.

A less obvious long-term economic impact stemming from the decline in the region's manufacturing base is the loss of relatively high-paying, year-round jobs the industry generated. The decline in the number of jobs in Southeast Alaska has been partially offset by an increase in retail trade and service sector employment. However, these jobs are often seasonal, part-time, and low-paying. The result is that, while employment may be increasing, the region is trading high-paying year-round jobs for low-paying seasonal jobs. This has led to increasingly seasonal local economies. With the timber industry decline, the seafood industry and tourism are now Southeast Alaska's largest industries in terms of employment and both are highly seasonal.

Due to litigation and court orders, the seven year average (1997-2003) timber volume sold on the Tongass has been significantly below the allowable sale quantity (ASQ) at 31 percent. Volume harvested has been 35 percent of the ASQ (USDA FS 2004d). The 2003 monitoring report for the Tongass National Forest examined employment and earnings figures including activities associated with private, State, BIA, and Native Corporation timber harvesting.

Regionally, State data has exhibited little or no growth. Employment in the wood products sector is lower than predictions in the Forest Plan. However, the Forest Plan figures included an estimate of self-employed persons, and they are not directly comparable to the Alaska State data that does not include such an estimate. Additionally, it should be noted that the Forest Plan projections were more related to environmental effects analysis than actual predictions (USDA FS 2004c).

Wage data from 2003 were not shown in the 2003 Monitoring Report because the employment and income information from the Alaska Department of Labor was incomplete. However, all indications were that wages per worker are comparable to those shown in the Forest Plan EIS (USDA FS 2004c).

Socioeconomic Cumulative Effects Specific to Alternative 1 (No Action)

Alternative 1 would not contribute to timber volumes available for harvest by the local wood products industry, thereby further contributing to the industry contraction that has occurred since the late 1990s. Planned offerings from 2006 through 2010 (Table 3-39) incorporate estimated volumes from the proposed action. Should the No Action Alternative be selected, no timber volumes from this project would contribute to achieving these planned harvest levels or meeting market demands for timber.

Other stimuli to the economies of nearby communities on Prince of Wales Island are introduced by the planned expansion of the Inter-Island Ferry system at Coffman Cove and expansion of the paved road system. Increased off-island visitation will stimulate development and growth of tourism industry businesses such as lodging, restaurants, and outfitting and guiding. This increased economic diversity may potentially reduce dependence on the timber industry. Increased tourism will likely also result in increased scrutiny of proposed timber management practices due to concerns about effects such as changes in scenery, wildlife populations, vegetation, water quality, and availability of areas that provide a sense of the Alaska wilderness.

Socioeconomic Cumulative Effects Common to Alternatives 2, 3, 4, and 5

Cumulative effects to jobs and income resulting from implementation of Alternatives 2, 3, 4, or 5 would be a contribution of approximately 15.1, 20.2, 12.4, and 18.3 MMBF of timber sale offerings respectively. Estimates of planned offerings from all ownerships from 2006 through 2010 as displayed under Cumulative Effects for Issue 2, Timber Sale and Local Economics (Table 3-39), include estimated contributions from the Tuxekan Project. These planned timber sale volumes would be expected to maintain an adequate supply of timber to support the local wood products industry in the near term. However, much of the economic distress experienced in rural Southeast Alaska is endemic and not likely to improve as a result of the Tuxekan project.

As described under Alternative 1, other stimuli to the economies of nearby Prince of Wales Island communities, will encourage development and growth of tourism industry businesses and increase economic diversity; potentially reducing dependence on the timber industry. Also as described under Alternative 1, increased tourism will likely result in increased scrutiny of proposed timber management practices.

Chapter 4 – Lists

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Chapter 4 - Lists

Abbreviations and Acronyms

AAC	Alaska Administrative Code
ACHP	Advisory Council on Historic Preservation
ACMA	Alaska Coast Management Act
ACMP	Alaska Coastal Management Program
ACOE	Army Corps of Engineers
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADGC	Alaska Division of Governmental Coordination
ADOT	Alaska Department of Transportation
AFHA	anadromous fish habitat assessment
AFRPA	Alaska Forest Resources and Practices Act
AHMU	Aquatic Habitat Management Unit
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
ASQ	allowable sale quantity
BF	board foot
BLM	Bureau of Land Management
BMPs	best management practices
CCR	clearcut with reserves
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMT	culturally modified tree
CT	commercial thinning
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DBH	diameter at breast height
DEIS	Draft Environmental Impact Statement
EFH	essential fish habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionary significant unit
EVC	existing visual condition
FCRPA	Federal Cave Resources Protection Act
FEIS	Final Environmental Impact Statement
FPA	Forest Practices Act
FSH	Forest Service Handbook
FY	fiscal year
GIS	geographic information system
GMU	game management unit
GS	group selection
HCI	habitat capability index
HSI	habitat suitability index
HU	hydrologic unit
IDT	interdisciplinary team
KPC	Ketchikan Pulp Corporation
LIDAR	light detection and ranging data
LSTA	logging system transportation analysis
LTF	log transfer facility
LUD	land use designation

LWD	large woody debris
MBF	thousand board feet
MIS	management indicator species
MMBF	million board feet
MMI	mass movement index
MOU	memorandum of understanding
MP	milepost
msl	mean sea level
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
NIC	noninterchangeable components
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NRHP	National Register of Historic Places
OGR	old growth reserve
OHV	off-highway vehicle
PA	Programmatic Agreement
PC	partial cutting
PCT	precommercial thinning
PNW	Pacific Northwest
POG	productive old growth
RARE II	Roadless Area Review and Evaluation II
RAW	reasonable assurance of windfirmness
RMA	Riparian Management Area
RMO	road management objective
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
RPA	Forest and Rangeland Renewable Resources Planning Act
SHPO	State Historic Preservation Officer
SOGR	Small old-growth reserve
SOPA	Schedule of Proposed Actions
STS	single-tree selection
TLMP	Tongass Land Management Plan
TPIT	Tongass Plan Implementation Team
TRUCS	Tongass Resource Use Cooperative Study
TTRA	Tongass Timber Reform Act
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
VAC	visual absorption capacity
VCU	value comparison unit
VMS	visual management system
VPOP	Interagency Viable Population Committee
VQO	visual quality objective
WAA	wildlife analysis area

Glossary

abiotic - Non-living. Climate is an abiotic component of ecosystems.

access - The opportunity to approach, enter, and make use of public lands.

access management - Acquiring rights and developing and maintaining facilities needed by people to get to and move through public lands (physical attributes).

active channel- - Unstable portion of a stream where the stream channel frequently changes course.

adaptive management - A type of natural resource management that implies making decisions as part of an on-going process. Monitoring the results of actions provides information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

adfluvial fish - Species of populations of fish that do not go to sea, but live in lakes and enter streams to spawn.

aerial logging - Removing logs from a timber harvest area by helicopter. Fewer required roads minimizes impacts.

affected environment - The current conditions of any given area. The resources for the affected environment are analyzed any time a project is proposed.

age class - An age grouping of trees according to an interval of years, usually 20 years. A single age class would have trees that are within 20 years of the same age, such as 1-20 years or 21-40 years.

airshed - A geographic area that shares the same air.

Alaska National Interest Lands Conservation Act (ANILCA) - Passed by Congress in 1980, this legislation designated 14 National Forest wilderness areas in Southeast Alaska. The Alaska National Interest Lands Conservation Act of December 2, 1980. Public Law 96-487, 96th Congress, 94 Stat. 2371-2551. Section 810 requires evaluations of subsistence impacts before changing the use of these lands.

Alaska Native Claims Settlement Act (ANCSA) - Public Law 92-203, 92nd Congress, 85 Stat. 2371-2551. Approved December 18, 1971, ANCSA provides for the settlement of certain land claims of Alaska natives and for other purposes.

allowable sale quantity (ASQ) - The amount of timber that may be sold within a certain time period from an area of suitable land. The suitability of the land and the time period are specified in the Forest Plan.

alluvial fan - A cone-shaped deposit of organic and mineral material made by a stream where it runs out onto a level plain or meets a slower stream.

alluvium - A general term for clay, silt, sand, gravel, or similar material deposited by a stream or other body of running water as a sorted or semisorted sediment in the bed of the stream.

anadromous fish - Species of fish that mature in the sea and migrate into streams to spawn.

aquifer - A body of rock that is saturated with water or transmits water. Wells tap water contained in an aquifer.

aspect - The direction a slope faces. A hillside facing east has an eastern aspect.

ASQ – see allowable sale quantity

background - The distant part of a landscape. The seen or viewed area located from 3 or 5 miles to infinity from the viewer. (See also "Foreground" and "Middleground.")

basal area - The area of the cross section of a tree trunk near its base, usually 4 and 1/2 feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective basal area of trees per acre.

bedload - Sand, silt, and gravel, or soil and rock debris rolled along the bottom of a stream by the moving water.

best management practice (BMP) – Practices determined to be the most effective and practicable means of controlling pollutants at levels compatible with environmental quality goals. BMPs were conceptualized in the 1972 FUS Federal Water Pollution Control Act. BMPs as defined in the USDA Forest Service Soil and Water Conservation Handbook are mandated for use in Region 10 under the Tongass Timber Reform Act.

big game - Large mammals, such as deer, elk, and antelope that are hunted for sport.

biological control - The use of natural means to control unwanted pests. Examples include introduced or naturally occurring predators such as wasps, or hormones that inhibit the reproduction of pests.

biological diversity - The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and the ecological processes that connect everything in a common environment.

biomass - The total weight of all living organisms in a biological community.

biome - The complex of living communities maintained by the climate of a region and characterized by a distinctive type of vegetation. North American biomes include the tundra, desert, prairie, and the western coniferous forests.

biota - The plant and animal life of a particular region.

biotic - Living. Green plants and soil microorganisms are biotic components of ecosystems.

blowdown - see windthrow

BMP – see best management practices

board foot - A measurement term for lumber or timber. It is the amount of wood contained in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide.

bole - The trunk of a tree.

braided streams or channels - A stream flowing in several dividing and reuniting channels resembling the strands of a braid, the cause of division being the obstruction by sediment and/or organic material deposited by the stream.

broadcast burn - A prescribed fire that burns a designated area. These controlled fires can reduce wildfire hazards, improve forage for wildlife and livestock, or encourage successful regeneration of trees.

browse - Twigs, leaves, and young shoots of trees and shrubs that animals eat. Browse is often used to refer to the shrubs eaten by big game, such as elk and deer.

buffer - A land area that is designated to block or absorb unwanted impacts to the area beyond the buffer. For example, buffer strips along a trail could block views that may be undesirable.

cable logging - Logging that involves the transport of logs from stump to collection points by means of suspended steel cables. Cable logging reduces the need for the construction of logging roads.

canopy - The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be use to describe lower layers in a multi-storied forest.

capability - An evaluation of a resource's inherent potential for use.

cave – "Any naturally occurring void, cavity, recess, or system of interconnected passages beneath the surface of the earth or within a cliff or ledge and which is large enough to permit a person to enter, whether the entrance is excavated or naturally formed. Such a term shall include any natural pit, sinkhole, or other opening which is an extension of a cave entrance or which is an integral part of the cave (36 CFR 261.2)".

cavity - A hole in a tree often used by wildlife species, usually birds, for nesting, roosting, and reproduction.

Cavity – (karst term) A solutional hollow in a limestone cave.

ccf - one hundred cubic feet

channel migration - Movement of a stream or river channel within a floodplain area usually over an extended period of time.

chemical control - The use of pesticides and herbicides to control pests and undesirable plant species.

clearcut - A harvest in which all or almost all of the trees are removed from a stand in one cutting.

clearcutting with reserves (CCR) - A clearcutting in which varying numbers of reserve trees are not harvested to attain goals other than regeneration. (Helms, 1998)

climax - The culminating stage in plant succession for a given site. Climax vegetation is stable, self-maintaining, and self-reproducing.

coarse filter management - Land management that addresses the needs of all associated species, communities, environments, and ecological processes in a land area. (See fine filter management.)

Code of Federal Regulations (CFR) - A codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government.

colluvium - A general term applied to any loose, heterogeneous, and incoherent mass of soil material and/or rock fragments deposited by rainwash, sheetwash, or slow continuous downslope creep, usually collecting at the base of gentle slopes or hillsides.

composition - What an ecosystem is composed of. Composition could include water, minerals, trees, snags, wildlife, soil, microorganisms, and plant species,

conifer - A tree that produces cones, such as a pine, spruce, or fir tree.

connectivity (of habitats) - The linkage of similar but separated vegetation stands by patches, corridors, or "stepping stones" of like vegetation. This term can also refer to the degree to which similar habitats are linked.

consumptive use - Use of resources that reduces the supply, such as logging and mining.

contour - A line drawn on a map connecting points of the same elevation.

corridor - Elements of the landscape that connect similar areas. Streamside vegetation may create a corridor of willows and hardwoods between meadows where wildlife feed.

cover - Any feature that conceals wildlife or fish. Cover may be dead or live vegetation, boulders, or undercut streambanks. Animals use cover to rest, feed, and escape from predators.

cover forage ratio - The ratio of hiding cover to foraging areas for wildlife species.

cover type (forest cover type) - Stands of a particular vegetation type that are composed of similar species.

created opening - An opening in the forest cover created by the application of even-aged silvicultural practices.

critical habitat - Areas designated for the survival and recovery of federally listed threatened or endangered species.

crown height - The distance from the ground to the base of the crown of a tree.

cubic foot (CF) - Equivalent to a cube of wood with 1-foot sides. The cubic foot volume is a measure of the total sound wood in a tree and is a more accurate depiction of wood volume than the board foot measure.

cultural resource - The remains of sites, structures, or objects used by people in the past; this can be historical or pre-historic.

cumulative effects - Effects on the environment that result from separate, individual actions that, collectively, become significant over time.

decision criteria - The rules and standards used to evaluate alternatives to a proposed action on National Forest land. Decision criteria are designed to help a decision maker identify a preferred choice from the array of alternatives.

decking area - A site where logs are collected after they are cut and before they are taken to the landing area where they are loaded for transport.

deer winter range - Locations that provide food and shelter for Sitka black-tail deer under moderately severe to severe winter conditions.

deferral - An area within or adjacent to a planned harvest unit that is not harvested during the planned rotation in order to meet Forest Plan standards and guidelines.

desired future condition - Land or resource conditions that are expected to result if goals and objectives are fully achieved.

developed recreation - Recreation that requires facilities that, in turn, result in concentrated use of the area. For example, skiing requires ski lifts, parking lots, buildings, and roads. Campgrounds require roads, picnic tables, and toilet facilities.

diameter at breast height (DBH) - The diameter of a tree 4 and 1/2 feet above the ground on the uphill side of the tree.

discount rate - The rate used to adjust future benefits or costs to their present value.

dispersed recreation - Recreation such as backpacking and scenic driving that occurs outside of developed recreation sites.

disturbance - An event such as forest fire or insect infestation that alters the structure, composition, or functions of an ecosystem.

Dissolution - The solubility of limestone in pure water is very low, but is vastly increased in the presence of carbon dioxide. This gas, dissolved in the water to produce carbonic acid, permits dissociation of calcium carbonate, and dissolution rates and loads are therefore directly related to carbon dioxide content. This accounts for the importance to limestone dissolution of plant growth; soil water contains greatly more carbon dioxide than stream waters.

doline - a sinkhole formed from dissolution of limestone

draft environmental impact statement (DEIS) - A statement of environmental effects for a major federal action that is released to the public and other agencies for comment and review prior to a final management decision. Required by Section 102 of the National Environmental Policy Act (NEPA).

eagle nest tree buffer zone - A 330-foot radius around eagle nest trees established in an agreement between the U.S. Fish and Wildlife Service and the Forest Service.

early forest succession - The biotic (or life) community that develops immediately following the removal or destruction of vegetation in an area. For instance, grasses may be the first plants to grow in an area that was burned.

ecological approach - An approach to natural resource management that considers the

relationships among all organisms, including humans, and their environment.

ecology - The interrelationships of living things to one another and the environment, or the study of these interrelationships.

ecoregion - An area over which the climate is sufficiently uniform to permit development of similar ecosystems on sites that have similar properties. Ecoregions contain many landscapes with different spatial patterns of ecosystems.

ecosystem - An arrangement of living and non-living things and the forces that move among them. Living things include plants and animals. Non-living parts of ecosystems may be rocks and minerals. Weather and wildfire are two of the forces that act within ecosystems.

ecosystem management - An ecological approach to natural resource management to assure productive, healthy ecosystems by blending social, economic, physical, and biological needs and values

ecotone - The transition zone between two biotic communities, such as between the forest and alpine zones.

ecotype - A population of a species in a given ecosystem that is adapted to a particular set of environmental conditions.

edge - The margin where two or more vegetation patches meet, such as a meadow opening next to a stand of trees.

effects - Effects, impacts, and consequences as used in this environmental impact statement are synonymous. Effects may be ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historical, cultural, economic, or social, and may be direct, indirect, or cumulative.

- *Direct effects: Results of an action occurring when and where the action takes place.*
- *Indirect effects: Results of an action occurring at a location other than where the action takes place and/or later in time, but in the reasonably foreseeable future.*
- *Cumulative effects: See "Cumulative Effects."*

element (of ecosystems) - An identifiable component, process, or condition of an ecosystem.

endangered species - A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

endemic plant or organism - A plant or animal that occurs naturally in a certain region and whose distribution is relatively limited geographically.

environmental analysis - An analysis of alternative actions and their predictable long and short-term environmental effects. Environmental analyses include physical, biological, social, and economic factors.

environmental assessment - A generally shorter version of an environmental impact statement. (See Environmental Impact Statement.)

environmental impact statement (EIS) - A statement of environmental effects of a proposed action and alternatives to it. The EIS is released to other agencies and the public for comment and review.

ephemeral streams - Streams that flow only as the direct result of rainfall or snowmelt. They have no permanent flow.

epikarst – The surface of karst. An intensely dissolved veneer consisting of an intricate network of intersecting dissolution-widened fissures, cavities, and tubes. It is this network of intersecting fissures that collect and transport surface waters and nutrients vertically to the underlying karst conduits.

erosion - The wearing away of the land surface by wind or water.

escape cover - Vegetation of sufficient size and density to hide an animal, or an area used by animals to escape predators.

Essential fish habitat - those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity(Magnuson-Stevens Act, 16 U.S.C. 1801 et seq). For the purpose of interpreting the definition of essential fish habitat: Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and spawning, breeding, feeding, or growth to maturity covers a species' full life cycle (EFH Interim Final Rule, 62 FR 66531).

estuary - For this document, estuary refers to the relatively flat, intertidal, and upland areas generally found at the heads of bays and mouths of streams. Predominantly mud and grass flats, an estuary is non-forested except for scattered trees.

even-aged management - Timber management such as clear cutting that results in the creation of stands of trees that are

executive order - An order or regulation issued by the President or some administrative authority under his or her direction.

fauna -The animal life of an area.

felling - Cutting down trees.

final cut - The removal of the last seed bearers or shelter trees after regeneration of new trees has been established in a stand being managed under the shelterwood system of silviculture.

final environmental impact statement (FEIS) - The final version of the statement of environmental effects required for major federal actions under Section 102 of the National Environmental Policy Act. It is a revision of the Draft Environmental Impact Statement (DEIS) to include public and agency responses to the draft. The decision maker chooses which alternative to select from the FEIS, and subsequently issues a Record of Decision (ROD).

fine filter management - Management that focuses on the welfare of a single or only a few species rather than the broader habitat or ecosystem. (See coarse filter management.)

fire cycle - The average time between fires in a given area.

fire regime - The characteristics of fire in a given ecosystem, such as the frequency, predictability, intensity, and seasonality of fire.

fiscal year (FY) - October 1 through September 30; e.g., October 1, 1992, through September 30, 1993 = FY 93.

fisheries habitat - Streams, lakes, and reservoirs that support fish, or have the potential to support fish.

floodplain - A lowland adjoining a watercourse. At a minimum, the area is subject to a 1% or greater chance of flooding in a given year.

flora - The plant life of an area.

fluvial - Of or pertaining to streams and rivers.

forage - All browse and non-woody plants that are eaten by wildlife and livestock.

forb - A broadleaf plant that has little or no woody material in it.

foreground - The part of a scene or landscape that is nearest to the viewer. The foreground is located less than 1/4 mile from the viewer. See also "Background" and "Middleground."

forest cover type - See cover type.

forest health - A measure of the robustness of forest ecosystems. Aspects of forest health include biological diversity; soil, air, and water productivity; natural disturbances; and the capacity of the forest to provide a sustaining flow of goods and services for people.

Forest roads and trails - Roads and trails under the jurisdiction of the Forest Service.

Forest Supervisor - The official responsible for administering National Forest lands on an administrative unit, usually one or more National Forests. The Forest Supervisor reports to the Regional Forester.

fragmentation - The splitting or isolating of patches of similar habitat, typically forest cover, but including other types of habitat. Habitat can be fragmented naturally or from forest management activities, such as clearcut logging.

frost heave - A land surface that is pushed up by the accumulation of ice in the underlying soil.

fuels management - The treatment of fuels that would otherwise interfere with effective fire management or control. For instance, prescribed fire can reduce the amount of fuels that accumulate on the forest floor before the fuels become so heavy that a natural wildfire in the area would be explosive and impossible to control.

fuels - Plants and woody vegetation, both living and dead, that are capable of burning.

fuelwood - Wood cut into short lengths for burning.

function - All the processes within an ecosystem through which the elements interact, such as succession, the food chain, fire, weather, and the hydrologic cycle.

game species - Any species of wildlife or fish that is harvested according to prescribed limits and seasons.

geographic information system (GIS) - An information processing technology to input, store, manipulate, analyze, and display spatial and attribute data to support the decision making process. It is a system of computer maps with corresponding site-specific information that can be electronically combined to provide reports and maps

geomorphic processes - Processes changing the form of the earth, such as volcanic activity, running water, or glacial action.

geomorphology - The study of the forms of the land surface and the processes producing them. Also the study of the underlying rocks or parent materials and the landforms present that were formed in geological time.

GIS - see geographic information system

grike - A vertical or sub-vertical cleft in a limestone pavement developed by solution along a joint or system of crisscrossing joints.

ground fire - A fire that burns along the forest floor and does nor affect trees with thick bark or high crowns.

ground water - The supply of fresh water under the earth's surface in an aquifer or in the soil.

group selection - A method of tree harvest in which trees are removed periodically in small groups. This silvicultural treatment results in small openings that form mosaics of age class groups in the forest.

habitat capability - The ability of a land area or plant community to support a given species of wildlife.

habitat diversity - A number of different types of wildlife habitat within a given area.

habitat diversity index - A measure of improvement in habitat diversity.

habitat - The area where a plant or animal lives and grows under natural conditions.

habitat type - A way to classify land area . A habitat type can support certain climax vegetation, both tree and undergrowth species. Habitat typing can indicate the biological potential of a site.

hard snags/soft snags - Hard snags are dead trees that have little decay and are generally still hard wood. Soft snags are dead trees that have a considerable amount of decay and are generally soft, broken wood.

hiding area or cover - Vegetation capable of hiding 90 percent of an adult elk or deer within 200 feet of a human's view.

horizontal diversity - The distribution and abundance of different plant and animal communities or different stages of plant succession across an area of land. Greater numbers of communities in an area mean greater horizontal diversity.

hydrologic cycle - The process where water evaporates, condenses, falls as precipitation, and returns to the ocean as run-off.

hydrology - The science dealing with the study of water on the land, in the soil and underlying rocks, and in the atmosphere.

Igneous intrusion - A formation in which magma (molten rock) is trapped beneath the surface of the Earth and pushes the rock located above it into a dome shape. It has a flat base and a convex upper surface. The magma cools and solidifies, and eventually, it is exposed (as the fractured sedimentary rock above it erodes away).

igneous rock - Rocks formed when high temperature, molten mineral matter cooled and solidified.

indicator species - A plant or animal species related to a particular kind of environment. Its presence indicates that specific habitat conditions are also present.

indigenous (species) - Native to a given land or water area by natural occurrence.

individual tree selection - see single-tree selection

instream flow - The quantity of water necessary to meet seasonal stream flow requirements to accomplish the purposes of the National Forests, including, but not limited to fisheries, visual quality, and recreational opportunities.

insurgence -A point of inflow for surface water into subsurface conduits.

integrated pest management (IPM) - IPM evaluates alternatives for managing forest pest populations, based on consideration of pest-host relationships.

interdisciplinary team - A team of individuals with skills from different disciplines that focuses on the same task or project.

intermediate cut - The removal of trees from a stand sometime between the beginning or formation of the stand and the regeneration cut. Types of intermediate cuts include thinning, release, and improvement cuttings.

intermittent stream - A stream that flows only at certain times of the year when it receives water from streams or from some surface source, such as melting snow.

inventoried roadless area (IRA) - An undeveloped area typically exceeding 5,000 acres that meets the minimum criteria for Wilderness consideration under the Wilderness Act and that was inventoried during the Forest Service’s Roadless Area Review and Evaluation (RARE II) process, subsequent assessments, or forest planning.

irretrievable - One of the categories of impacts mentioned in the National Environmental Policy Act to be included in statements of environmental impacts. An irretrievable effect applies to losses of production or commitment of renewable natural resources. For example, while an area is used as a ski area, some or all of the timber production there is irretrievably lost. If the ski area closes, timber production could resume; the loss of timber production during the time that the area was devoted to winter sports is irretrievable. However, the loss of timber production during that time is not irreversible, because it is possible for timber production to resume if the area is no longer used as a ski area.

irreversible - A category of impacts mentioned in statements of environmental impacts that applies to non-renewable resources, such as minerals and archaeological sites. Irreversible effects can also refer to effects of actions that can be renewed only after a very long period of time, such as the loss of soil productivity.

karst - A type of topography that develops as the result of the dissolution of soluble rocks, in this case limestones and marbles. Dissolution of the subsurface strata produces a landscape that is characterized by well-developed subsurface drainage, collapse features such s sinkholes, dry valleys, vertical shafts, caves, and fluted rock surfaces (epikarst).

key summer range - The portion of a wildlife species' summer range that is essential for reproduction cycles. Deer require "fawning areas" where does give birth and hide their fawns for an essential period of time in the spring.

key winter range - That portion of big game's range where the animals find food and cover during severe winter weather.

Knutsen-Vandenburg Fund (KV) - The portion of timber sale receipts collected and used for reforestation and other renewable resource projects on the sale area.

ladder fuels - Vegetation located below the crown level of forest trees that can carry fire from the forest floor to tree crowns. Ladder fuels may be low-growing tree branches, shrubs or smaller trees.

Land and Resource Management Plan - Also called the Forest Plan or just the Plan, this document guides the management of a particular National Forest and establishes management standards and guidelines for all lands of that National Forest.

land class - The topographic relief of a unit of land. Land classes are separated by slope; this coincides with the timber inventory process. The three land classes used in the Forest Plan are defined by the following slope ranges: 0 to 35 percent, 36 to 55 percent, and greater than 55 percent.

land use designation (LUD) – An area of the Forest is assigned to one of 19 different land use designations that describe the attributes and resource conditions that the area should be managed for.

land use planning - The process of organizing the use of lands and their resources to best meet people's needs over time, according to the land's capabilities.

landing - Any place where cut timber is assembled for further transport from the timber sale area.

landline - The boundary lines for National Forest land.

landscape - A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human impacts. Landscapes are often used for coarse grain analysis.

large woody debris (LWD) - Any large piece of relatively stable woody material having a diameter of at least 4 inches and a length greater than 3 feet that intrudes into the stream channel.

late forest succession - The stage of forest succession in which most of the trees are mature or over-mature.

life zone - Areas or "belts" of land that have distinct plant and animal characteristics determined by elevation, latitude, and climate.

litter (forest litter) - The freshly fallen or only slightly decomposed plant material on the forest floor. This layer includes foliage, bark fragments, twigs, flowers, and fruit.

log transfer facility (LTF) - See marine access facility.

logging residue (slash) - The residue left on the ground after timber cutting. It includes unused logs, uprooted stumps, broken branches, bark, and leaves. Certain amounts of slash provide important ecosystem roles, such as soil protection, nutrient cycling, and wildlife habitat.

logging systems - The equipment configuration employed for yarding logs; that is, moving them from the stump to the "landing," the point on a road at which they are loaded on trucks for transportation from the unit. Logging systems fall into the following main categories, in order of increasing cost:

- *Ground-based systems: These employ mobile machines that travel throughout the unit to skid or swing logs to the landing. Tractor logging, employing wheeled or tracked tractors or "skidders" to "skid" logs, is widely used in the South 48 but rarely on the Tongass because of the wet or rocky soils. Much more common in Southeast Alaska is shovel logging, in which a log loader or "shovel" moves logs from the stump to the landing by repeatedly swinging them closer. Shovel logging has relatively low site impacts since the machine typically makes only one pass over a piece of ground to reposition itself. On wet sites, impacts can be largely mitigated by having the machine build a pad of slash upon which to travel. Ground systems can be used to log partial cuts or clearcuts on flat or moderate terrain.*
- *Cable systems: These employ a stationary "yarder" at the landing; that is, a set of winches powering wire rope cables that travel through the top of an integrally mounted steel tower. The cables move logs to the landing, lifting them partly or completely clear of the ground through the lift provided by the tower. Because the equipment is stationary at the landing, and does not travel on the unit, site impacts are limited to soil and stream disturbance caused by dragging the logs. "Full suspension," where the log is lifted completely clear of the ground, may be feasible, in which case these impacts are absent. "Partial suspension," in which one end of the log is lifted clear of the ground while the other end drags on the ground, is more readily achievable. Cable systems may be employed on any terrain, with different systems being adapted to different site conditions.*
- *Highlead: A simple cable yarding system, using a two-drum yarder to provide lift to the front end of the logs. "Grabinski" is a modified highlead cable system capable of*

enhanced lift. Highlead is capable of clearcut logging, but not partial cuts.

- *Skyline: The various skyline systems employ an additional cable or "skyline" to impart additional lift to the logs. Site impacts are therefore reduced. The system common in southeast Alaska is the "running skyline," which is typically highly mobile. It is capable of logging clearcuts and, in certain conditions, partial cuts. The "slackline" is typically less mobile, but with greater distance capabilities and with the capability to "sideblock" logs from out to the side of the skyline. It is thus usually applied in the more difficult terrain. It is capable of yarding clearcuts and, for some equipment configurations and site conditions, partial cuts. The "shotgun" or "gravity return" system is restricted to uphill yarding. It can log clearcuts and, in some equipment configurations, partial cuts.*
- *Cold-deck and swing: An obsolete system once widely employed in Alaska, whereby a highlead yarder assembled a "cold-deck" or pile of logs for subsequent transportation by skyline to the landing.*
- *A-frame: Now also obsolete, this system employed a yarder mounted on a raft to yard logs into a bay or lake.*
- *Multispan skyline: An intermediate support spar is rigged to lift the skyline clear of topographical obstacles. This system has found very little application in old-growth timber but may prove more practical in future second growth thinning operations.*
- *Aerial logging systems: Systems where the cut logs are moved from the stump to the landing without touching the ground. The only such system practical for the Alaska operating environment is helicopter logging, which employs a heavy-lift helicopter for yarding. Typically, the maximum practical helicopter yarding distance is 5,000 feet; additionally, the flight path cannot exceed 40 percent downhill or 30 percent uphill, and a relatively large landing of approximately one acre is required. Helicopter logging is capable of logging any silvicultural prescription.*

LUD – see land use designation

MBF - thousand board feet (see board feet.)

MMBF- million board feet (see board feet.)

MMCF - million cubic feet (see cubic feet.)

macro climate - The general, large-scale climate of a large area, as distinguished from the smaller scale micro climates within it.

management action - Any activity undertaken as part of the administration of the National Forest.

management indicator species (MIS) - A wildlife species whose population will indicate the health of the ecosystem in which it lives and, consequently, the effects of forest management activities to that ecosystem. MIS species are selected by land management agencies. (See "indicator species".)

marine and estuarine province - Open ocean overlying the continental shelf and adjacent areas of coastlines that are influenced by tidal activity.

Marine Access Facility (MAF) – A facility that is used for transferring commercially harvested logs to and from a vessel or log raft, or the formation of a log raft. It is wholly or partially constructed in waters of the United States, and its location and construction are regulated by the 1987 Amendments to the Clean Water Act. Formerly termed "terminal transfer facility", "log dump", or log transfer facility."

mass movement or mass wasting - The down-slope movement of large masses of earth material by the force of gravity. Also called a landslide.

matrix - The least fragmented, most continuous pattern element of a landscape; the

vegetation type that is most continuous over a landscape.

mature timber - Trees that have attained full development, especially height, and are in full seed production.

McGilvery (soil series) - Soil series composed of a thin surface layer (less than 8 inches deep) of organic material overlying bedrock. These soils are associated with cliffs and rock outcrops and are sensitive to disturbance.

mean annual increment of growth - The total increase in size or volume of individual trees. Alternatively, it can refer to the increase in size and volume of a stand of trees at a particular age, divided by that age in years.

memorandum of understanding (MOU) - A legal agreement between the Forest Service and others agencies resulting from consultation between agencies that states specific measures the agencies will follow to accomplish a large or complex project.

microclimate - The climate of a small site. It may differ from the climate at large of the area due to aspect, tree cover (or the absence of tree cover), or exposure to winds.

middleground - The visible terrain beyond the foreground where individual trees are still visible but do not stand out distinctly from the landscape; area located from 1/4 mile to 5 miles from the viewer. See also “Foreground” and “Background.”

mineral soil - Soil that consists mainly of inorganic material, such as weathered rock, rather than organic matter.

MIS – see management indicator species

mission (of the USDA Forest Service) - "To Care for the Land and Serve the People". As set forth in law, the mission is to achieve quality land management under the sustainable multiple-use management concept to meet the diverse needs of people.

mitigation - Actions taken to avoid, minimize, or rectify the impact of a land management activities.

mixed stand - A stand consisting of two or more tree species.

model - A representation of reality used to describe, analyze, or understand a particular concept. A model may be a relatively simple qualitative description of a system or organization, or a highly abstract set of mathematical equations. A model has limits to its effectiveness and is used as one of several tools to analyze a problem.

monitoring and evaluation - The periodic evaluation of forest management activities to determine how well objectives were met and how management practices should be adjusted. See "adaptive management".

moraine - A mound, ridge, or other distinct accumulation of unsorted, unstratified glacial drift, predominantly till, deposited chiefly by direct action of glacier ice, in a variety of topographic landforms that are independent of control by the surface on which the drift lies.

mortality - Trees that were merchantable and have died within a specified period of time. The term mortality can also refer to the rate of death of a species in a given population or community.

mosaic - Areas with a variety of plant communities over a landscape, such as areas with trees and areas without trees occurring over a landscape.

multiple-aged stands - An intermediate form of stand structure between even and uneven-aged stands. These stands generally have two or three distinct tree canopy levels occurring within a single stand.

multiple-use management - The management of all the various renewable surface resources of National Forest lands for a variety of purposes such as recreation, range, timber, wildlife and fish habitat, and watershed.

muskeg - In Southeast Alaska, a type of bog that has developed over thousands of years in depressions or flat areas on gentle to steep slopes. Also called peatlands.

National Environmental Policy Act (NEPA) - Congress passed NEPA in 1969 to encourage productive and enjoyable harmony between people and their environment. One of the major tenets of NEPA is its emphasis on public disclosure of possible environmental effects of any major action on public lands. Section 102 of NEPA requires a statement of possible environmental effects to be released to the public and other agencies for review and comment.

National Forest Management Act (NFMA) - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act requiring the preparation of regional guides and forest plans and the preparation of regulations to guide that development.

National Forest recreation sites (NFRS) - National Forest recreation sites that have been inventoried.

National Historic Preservation Act (1966, NHP) - Establishes the State Historic Preservation Officer (SHPO) and provides oversight for cultural resource assessment and consideration of effect on historic properties under Section 106.

National Wild and Scenic River System - Rivers with outstanding scenic, recreational, geological, fish, and wildlife, historic, cultural, or other similar values, designated by Congress under the Wild and Scenic Rivers Act of 1968 and amended in 1986, for preservation of their free-flowing condition. May be classified and administered under one or more of the following categories: Wild, Scenic, and Recreational.

Native Selection - Application by Native corporations and individuals to a portion of the U.S. Department of Interior Bureau of Land Management for conveyance of lands withdrawn in fulfillment of Native entitlements established under ANCSA.

natural barrier - A natural feature, such as a dense stand of trees or downfall that will restrict animal travel.

natural disturbance - See disturbance.

natural range of variability - See range of variability

natural resource - A feature of the natural environment that is of value in serving human needs.

nest survey - A way to estimate the size of a bird population by counting the number of nests in a given area.

net sawlog volume - Tree or log volume suitable in size and quality to be processed into lumber. In Southeast Alaska, depending on the market, the volume may be processed as pulp or lumber.

no action alternative - The most likely condition expected to exist in the future if management practices continue unchanged.

noncommercial vegetative treatment - The removal of trees for reasons other than timber production.

non-consumptive use - The use of a resource that does not reduce the supply. For instance, bird watching is a non-consumptive use of wildlife. Boating and fishing are non-consumptive uses of water.

nongame - Wildlife species that are not hunted for sport.

nonpoint source pollution - Pollution whose source is not specific in location. The sources of the discharge are dispersed, not well defined, or constant. Rainstorms and snowmelt often make this type of pollution worse. Examples include sediments from logging activities and runoff from agricultural chemicals.

non-renewable resource - A resource whose total quantity does not increase measurably over time, so that each use of the resource diminishes the supply.

notice of intent (NOI) - A notice printed in the Federal Register announcing that an Environmental Impact Statement will be prepared. The NOI must describe the proposed action and possible alternatives, describe the agency's proposed scoping process, and provide a contact person for further information.

nutrient cycle - The circulation of chemical elements and compounds, such as carbon and nitrogen, in specific pathways from the non-living parts of ecosystems into the organic substances of the living parts of ecosystems, and then back again to the non-living parts of the ecosystem. For instance, nitrogen in wood is returned to the soil as the dead tree decays; the nitrogen again becomes available to living organisms in the soil, and upon their death, the nitrogen is available to plants growing in that soil.

old growth - Old forests often containing several canopy layers, variety in tree sizes and species, decadent old trees, and standing and dead woody material.

old-growth reserve (OGR) - A contiguous unit of old-growth habitat to be managed to maintain the integrity of the old-growth forest ecosystem.

organic soil - Soil at least partly derived from living matter, such as decayed plant material.

over-mature timber - Trees that have attained full development, particularly in height, and are declining in vigor, health, and soundness.

overstory - The upper canopy layer; the plants below comprise the understory.

parent material - The mineral or organic matter from which the upper layers of soil are formed.

park-like structure - Stands with large scattered trees and open growing conditions, usually maintained by ground fires.

partial cut - Method of harvesting trees where any number of live stems are left standing in any of various spatial patterns. This does not include clearcutting. Can include seed tree, shelterwood, or other methods.

partial retention - A visual quality objective that, in general, means man's activities may be evident but must remain subordinate to the characteristic landscape.

patch - An area of homogeneous vegetation, in structure and composition.

percolation - Downward flow or infiltration of water through the pores or spaces of rock or soil.

perennial stream - A stream that flows throughout the year and from source to mouth.

personal use - The use of a forest product, such as firewood, for home use and not for commercial use.

planning area - The area of National Forest land covered by a Regional Guide or Forest Plan.

planning period - The 50-year time frame for which goods, services, and effects were projected in the development of the Forest Plan.

plant association - A potential natural plant community of definite floristic composition and uniform appearance. (FSM 2060.)

plant community - A group of one or more populations of plants in a common spatial arrangement. (FSM 2060)

PNV - see present net value.

pole timber - Trees between 5 and 9 inches in diameter at breast height.

pole or sapling - The stage of forest succession in which trees are between 3 and 7

inches in diameter and are the dominant vegetation.

population viability - Ability of a species to sustain itself.

potential natural community - The biotic community that would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbance under present environmental conditions. Grazing by native fauna, natural disturbances, such as drought, floods, fire, insects, and disease, are inherent in the development of potential natural communities that may include naturalized exotic species. (FSM 2060.)

potential natural vegetation - The vegetation that would exist today if man were removed from the scene and if the plant succession after his removal were telescoped into a single moment. The time compression eliminates the effects of future climatic fluctuations, while the effects of man's earlier activities are permitted to stand. The maps and descriptions of potential natural vegetation developed by Kuchler (1964) for the 48 conterminous States are among the most widely used.

precommercial thinning - Removing some of the trees from a stand that are too small to be sold for lumber or house logs, so the remaining trees will grow faster.

predator - An animal that lives by preying on other animals. Predators are at or near the tops of food chains.

pre-existing use - Land use that may not conform to a zoning ordinance but existed prior to the enactment of the ordinance.

preparatory cut - The removal of trees near the end of a rotation to open the canopy so the crowns of seed bearing trees can enlarge. This improves seed production and encourages natural regeneration. (See rotation.)

prescribed fire - Fire set intentionally in wildland fuels under prescribed conditions and circumstances. Prescribed fire can rejuvenate forage for livestock and wildlife or prepare sites for natural regeneration of trees.

prescription - Management practices selected to accomplish specific land and resource management objectives.

present net value (PNV), also called **present net worth** - The measure of the economic value of a project when costs and revenues occur in different time periods. Future revenues and costs are "discounted” to the present by an interest rate that reflects the changing value of a dollar over time. The assumption is that dollars today are more valuable than dollars in the future. PNV is used to compare project alternatives that have different cost and revenue flows.

presuppression - Activities carried out in advance of fire occurrence to ensure effective suppression when the need arises.

primitive ROS (Recreation Opportunity Spectrum) - A classification of wilderness and recreation opportunity. It is characterized by an essentially unmodified environment, where trails may be present but structures are rare, and where it is highly probable to be isolated from the sights and sounds of people. (See ROS.)

productive - The ability of an area to provide goods and services and to sustain ecological values.

productive old growth (POG) - Old-growth stands capable of producing 20 cubic feet per acre per year with 8,000 or more board feet per acre.

prognosis - A computer model for timber growth and yield. It projects per-acre growth and volume yield for commercial timber stands.

public domain - The territory ceded to the Federal government by the original thirteen states, plus additions by treaty, cession, and purchase.

public involvement - The use of appropriate procedures to inform the public, obtain early and continuing public participation, and consider the views of interested parties in planning and decision-making.

public land - Land for which title and control rests with a government - Federal, state, regional, county, or municipal.

range - Land on which the principle natural plant cover is composed of native grasses, forbs, and shrubs that are valuable as forage for livestock and big game.

range management - The art and science of planning and directing range use intended to yield the sustained maximum animal production and perpetuation of the natural resources.

range of variability (also called the historic range of variability or natural range of variation.) - The components of healthy ecosystems fluctuate over time. The range of sustainable conditions in an ecosystem is determined by time, processes (such as fire), native species, and the land itself. For instance, ecosystems that have a 10-year fire cycle have a narrower range of variation than ecosystems with 200-300 year fire cycle. Past management has placed some ecosystems outside their range of variability. Future management should move such ecosystems back toward their natural, sustainable range of variation.

ranger district - The administrative sub-unit of a National Forest that is supervised by a District Ranger who reports directly to the Forest Supervisor.

raptor - A bird of prey, such as an eagle or hawk.

RARE II - Roadless Area Review and Evaluation. The national inventory of roadless and undeveloped areas within the National Forests and Grasslands.

recharge - The addition of water to ground water by natural or artificial processes.

record of decision (ROD) - An official document in which a deciding official states the chosen activity (alternative) that will be implemented from a prepared EIS.

Recreation Opportunity Spectrum (ROS) - The land classification system that categorizes land by its setting and the probable recreation experiences and activities it affords.

reforestation - The restocking of an area with forest trees, by either natural or artificial means, such as planting.

regeneration - The renewal of a tree crop by either natural or artificial means. The term is also used to refer to the young crop itself.

Regional Forester - The official of the USDA Forest Service responsible for administering an entire region of the Forest Service.

release cutting - Removal of competing vegetation to allow desired tree species to grow.

removal cut - The removal of the last seed bearers or shelter trees after regeneration is established.

reserve areas - Areas reserved from harvest (no cutting) in perpetuity or for one rotation (2054). Such areas are deferred from harvest at this time to reduce cumulative effects or to meet specific Forest Plan Standards and Guidelines. Reserves lasting in perpetuity are in areas that became unsuitable following reconnaissance of the originally planned harvest unit (e.g., high-vulnerability karst, RMAs, MMI 4 soils). Reserves lasting until the end of the rotation are in areas of suitable land in the original planned units (e.g., additional buffers that are greater than RMA or karst minimum requirements, buffers placed on Class III or IV streams). These areas are available for future harvest, but have been deferred from harvest for one rotation.

reserve trees - Merchantable or sub merchantable trees and snags that are left within the harvest unit to provide biological habitat components over the next management cycle.

residual stand - The trees remaining standing after an event such as selection cutting.

resilience - The ability of an ecosystem to maintain diversity, integrity, and ecological processes following a disturbance.

Resource Planning Act (RPA) assessment and program - The RPA Assessment is prepared every 10 years and describes the potential of the nation's forests and rangelands to provide a sustained flow of goods and services. The RPA Program is prepared every 5 years to chart the long-term course of Forest Service management of the National Forests, assistance to state and private landowners, and research. They are prepared in response to Sections 3 and 4 of the Forest and Rangeland Renewable Resources Planning Act of 1974 (16 U.S.C. 1601).

responsible official - The Forest Service employee who has been delegated the authority to carry out a specific planning action.

restoration (of ecosystems) - Actions taken to modify an ecosystem to achieve a desired, healthy, and functioning condition.

resurgence - Point at which an underground stream reaches the surface and becomes a surface stream.

revegetation - The re-establishment and development of a plant cover by either natural or artificial means, such as re-seeding.

riparian area - The area along a watercourse or around a lake or pond.

riparian ecosystem - The ecosystems around or next to water areas that support unique vegetation and animal communities resulting from the influence of water.

riparian management area (RMA) - The area including water, land, and plants adjacent to perennial streams, lakes, and other bodies of water that is managed for the inherent qualities of the riparian ecosystem.

roads - A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. (36 CFR 212.1).

- *National Forest System Road. A forest road other than a road that has been authorized by a legally documented right-of-way held by a State, county, or other local public road authority.*
- *Unauthorized Roads. A road that is not a forest road or a temporary road and that is not included in a forest transportation atlas...*
- *Temporary Roads. A road necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road and that is not included in a forest transportation atlas.*
- *Arterial: Roads usually developed and operated for long-term land and resource management purposes to constant service.*
- *Collector: Collects traffic from forest local roads; usually connects to a forest arterial or public highway.*
- *Local: Provides access for a specific resource use activity such as a timber sale or recreational site, although other minor uses may be served.*

ROD - see record of decision

ROS - see recreation opportunity spectrum.

rotation - The number of years required to establish and grow timber crops to a specified condition of maturity.

roundwood - Timber and fuelwood prepared in the round state, such as house logs and telephone poles.

run-off - The portion of precipitation that flows over the land surface or in open channels.

sanitation salvage - The removal of dead, damaged, or susceptible trees primarily to prevent the spread of pests or disease and promote forest health.

sapling - A loose term for a young tree more than a few feet tall and an inch or so in diameter that is typically growing vigorously.

sawtimber (sawlog) - Trees that are 9 inches in diameter at breast height or larger that can be made into lumber.

scale - In ecosystem management, it refers to the degree of resolution at which ecosystems are observed and measured.

scoping - The ongoing process to determine public opinion, receive comments and suggestions, and determine issues during the environmental analysis process. It may involve public meetings, telephone conversations, or letters.

second growth - Forest growth that was established after some kind of interference with the previous forest crop, such as cutting, fire, or insect attack.

seed tree harvest - Removal of the mature timber crop from an area in one cut, except for a certain number of seed bearers.

selective cutting - A system in which groups of trees or individual trees are removed periodically from the forest based on economic criteria aimed at maximizing logging revenues rather than the need to ensure satisfactory regeneration or to maintain stand growth rates and quality of timber production. The term is often used synonymously with selection cutting, but this is seldom correct because the management goals of the two systems differ. Selective cutting provides periodic revenues from the forest but is not specifically designed to improve the growing conditions of the trees remaining. The practice of selective cutting has historically resulted in the selection of the biggest and best trees for cutting, leaving behind damaged trees and degraded ecosystem functions.

sensitive species - Plant or animal species that are susceptible to habitat changes or impacts from activities. The official designation is made by the USDA Forest Service at the Regional level and is not part of the designation of Threatened or Endangered Species made by the US Fish and Wildlife Service.

sensitivity level - A map inventory that measures people’s concern for the scenic quality of the National Forests. In 1980, the Tongass National Forest assigned sensitivity levels to land areas viewed from anchorages, plane and boat routes, roads, trails, public-use areas, and recreation cabins.

- *Level I: Includes all seen areas from primary travel routes, use areas, and water bodies where at least three-fourths of the Forest visitors have a major concern for scenic quality.*
- *Level II: Includes all seen areas from primary travel routes, use areas, and water bodies where at least one-fourth of the Forest visitors have a major concern for scenic quality.*

- *Level III: Includes all seen areas form secondary travel routes, use areas, and water bodies where less than one-fourth of the Forest visitors have a major concern for scenic quality.*

seral - The stage of succession of a plant or animal community that is transitional. If left alone, the seral stage will give way to another plant or animal community that represents a further stage of succession.

shelterwood - A cutting method used in a more or less mature stand, designed to establish a new crop under the protection of the old.

silviculture - The art and science that promotes the growth of single trees and the forest as a biological unit.

silvicultural system - The cultivation of forests; the result is a forest of a distinct form. Silvicultural systems are classified according to harvest and regeneration methods and the type of forest that results.

Single-tree selection (STS) - The removal of individual trees from certain size and age classes over an entire stand area. Regeneration is mainly natural, and an uneven aged stand is maintained.

sinkhole – A term used to describe relatively shallow, bow- or funnel-shaped depressions ranging in diameter from a few feet to more than 3,000 feet. These depressions are generally formed by dissolution of and subsequent settlement of bedrock to form a depression or collapse feature.

site index - A measure of the relative productive capacity of an area for growing wood. Measurement of site index is based on height of the dominant trees in a stand at a given age.

site preparation - The general term for removing unwanted vegetation, slash, roots, and stones from a site before reforestation. Naturally occurring wildfire, as well as prescribed fire can prepare a site for natural regeneration.

size class - One of the three intervals of tree stem diameters used to classify timber in the Forest Plan database. The size classes are: Seedling/Sapling (less than 5 inches in diameter), Pole Timber (5 to 7 inches in diameter), and Sawtimber (greater than 7 inches in diameter)

skidding - Hauling logs by sliding, not on wheels, from stump to a collection point.

skyline logging - A logging system used to remove timber from steep slopes. Logs are brought up -slope on a suspended cable, or skyline. Since the weight of the log is completely or partially supported by the cable, there is little disturbance to soil or other vegetation.

slash - The residue left on the ground after timber cutting or left after a storm, fire, or other event. Slash includes unused logs, uprooted stumps, broken or uprooted stems, branches, bark, etc.

slump - A landslide where the underlying rock masses tilt back as they slide from a cliff or escarpment.

small game - Birds and small animals normally hunted or trapped.

snag - A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.

soil compaction - The reduction of soil volume. For instance, the weight of heavy equipment on soils can compact the soil and thereby change it in some ways, such as in its ability to absorb water.

soil productivity - The capacity of a soil to produce a specific crop. Productivity depends on adequate moisture and soil nutrients, as well as favorable climate.

solution rill - Small channel cut by flowing water in the floor, wall, or ceiling of a cave.

sound wood - Timber that is in solid, whole, good condition. Sound wood is free from damage, decay, or defects.

special use permit - A permit issued to an individual or group by the USDA Forest Service for use of National Forest land for a special purpose. Examples might be a Boy Scout Jamboree or a mountain bike race.

split yarding - The process of separating the direction of timber harvest yarding into opposite directions.

stand - A group of trees that occupies a specific area and is similar in species, age, and condition.

standards and guidelines - Requirements found in a Forest Plan which impose limits on natural resource management activities, generally for environmental protection. Forest Plan standards must be met; while guidelines direct the conditions that management should strive for.

State Historic Preservation Office (SHPO) - State office that oversees federal and state programs for cultural resources. The Forest seeks concurrence from SHPO for all undertakings under the terms of Section 106 of the National Historic Preservation Act.

stewardship - Caring for the land and its resources to pass healthy ecosystems to future generations.

stocking level - The number of tree in an area as compared to the desirable number of trees for best results, such as maximum wood production.

stream classes - A means to categorize stream channels based on their fish production values. There are four stream classes defined by the Forest Plan:

- *Class I: Streams and lakes with anadromous or adfluvial fish habitat; or high-quality resident fish waters, or habitat above fish migration barriers known to be reasonable enhancement opportunities for anadromous fish.*
- *Class II: Streams and lakes with resident fish or fish habitat and generally steep (6 to 25 percent or higher) gradients where no anadromous fish occur, and otherwise not meeting Class I criteria.*
- *Class III: Streams are perennial and intermittent streams that have no fish populations or fish habitat, but have sufficient flow or sediment and debris transport to directly influence downstream water quality or fish habitat capability. These streams have bankfull widths greater than 1.5 meters (5 feet) and have channel incision into the surrounding hillslope greater than 5 meters (15 feet).*
- *Class IV: Intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to directly influence downstream water quality or fish habitat capability. Class IV streams do not have the characteristics of Class I, II, or III streams, and have a bankfull width of at least 0.3 meters (1 foot). These streams generally are shallowly incised into the surrounding hillslope. Incision depth may be determined from side-slope angle and length. Incisions from three to 5 meters in depth may be categorized as either Class III or Class IV depending on other stream characteristics.*
- *Nonstreams. Rills and other watercourses, generally intermittent and less than one foot in bankfull width, showing little or no incision into the surrounding hillslope or evidence of scour.*

stream order - First-order streams are the smallest unbranched tributaries; second-order streams are initiated at the point where two first-order streams meet; third-order streams are initiated by the point where two second-order streams meet, and so on.

stringer - A strip of vegetation different from surrounding vegetation, such as a stringer of aspen in an area of spruce.

structure - How the parts of ecosystems are arranged, both horizontally and vertically. Structure might reveal a pattern, or mosaic, or total randomness of vegetation.

stumpage - The value of timber as it stands uncut in terms of dollar value per thousand board feet.

subsistence - Section 803 of the Alaska National Interest Lands Conservation Act defines subsistence use as "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible by-products of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade."

subsistence use area - Important Subsistence Use Areas include the "most reliable" and "most often hunted" categories from the Tongass Resource Use Cooperative Survey (TRUCS) and from subsistence survey data from ADF&G, the University of Alaska, and the Forest Service, Region 10. Important use areas include both intensive and extensive use areas for subsistence harvest of deer, furbearers, and salmon.

substantive comment - A comment that provides factual information, professional opinion, or informed judgment germane to the action being proposed.

succession - The natural replacement, in time, of one plant community with another. Conditions of the prior plant community (or successional stage) create conditions that are favorable for the establishment of the next stage.

successional stage - A stage of development of a plant community as it moves from bare ground to climax. The grass-forb stage of succession precedes the woody shrub stage.

suitability - The appropriateness of certain resource management to an area of land. Suitability can be determined by environmental and economic analysis of management practices.

surface resources - Renewable resources that are on the surface of the earth, such as timber and forage, in contrast to ground water and minerals that are located beneath the surface.

sustainability - The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

sustainable - The yield of a natural resource that can be produced continually at a given intensity of management is said to be sustainable.

sustained yield - The yield that a renewable resource can produce continuously at a given intensity of management.

target - A National Forest's annual goals for accomplishment for natural resource programs. Targets represent the commitment the Forest Service has with Congress to accomplish the work Congress has funded, and are often used as a measure of the agency's performance.

tentatively suitable forest land - Forest land that is producing or is capable of producing crops of industrial wood and (1) has not been withdrawn by Congress, the Secretary of Agriculture, or the Chief of the Forest Service; (2) existing technology and knowledge is available to ensure timber production without

irreversible damage to soils productivity or watershed conditions; (3) existing technology and knowledge, as reflected in current research and experience, provide reasonable assurance that it is possible to restock adequately within five years of final harvest; and (4) adequate information is available to project responses to timber management activities.

thermal cover - Cover used by animals against weather. For elk, thermal cover can be found in a stand of coniferous trees at least 40 feet tall with a crown closure of at least 70%.

thinning - A cutting made in an immature stand of trees to accelerate growth of the remaining trees or to improve the form of the remaining trees.

threatened species - Those plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

threshold - The point or level of activity beyond which an undesirable set of responses begins to take place within a given resource system.

tiering - Eliminating repetitive discussions of the same topic by incorporating by reference. The general discussion in an Environmental Impact Statement of broader scope; e.g., this document is tiered to the Tongass Land and Resource Management Plan, as amended.

timber appraisal - Establishing the fair market value of timber by taking the selling value minus manufacturing costs, the cost of getting logs from the stump to the manufacturer, and an allowance for profit and risk.

timber classification - Forested land is classified under each of the land management alternatives according to how it relates to be management of the timber resource. The following are definitions of timber classifications used for this purpose.

- *Nonforest: Land that has never supported forests and land formerly forested where use for timber production is now precluded by development or other uses.*
- *Forest: Land at least 10 percent stocked (based on crown cover) by forest trees of any size or land formerly having had such tree cover and not currently developed for nonforest use.*
- *Suitable or suitable available: Land to be managed for timber production on a regulated basis.*
- *Unsuitable: Forest land withdrawn from timber utilization by statute or administrative regulation (for example, wilderness) or identified as inappropriate for timber production in the forest planning process.*
- *Commercial forest: Forest land tentatively suitable for the production of continuous crops of timber and that has not been withdrawn.*

timber stand improvement (TSI) - Actions to improve growing conditions for trees in a stand, such as thinning.

Tongass Timber Reform Act (TTRA) - This act (1990) requires annual appropriations for timber management on the Tongass National Forest, with a provision providing for the multiple use and sustained yield of all renewable resources.

tractor logging - A logging method that uses tractors to carry or drag logs from the stump to a collection point.

treatment area - The site- specific location of a resource improvement activity.

tree opening - An opening in the forest created by even-aged silvicultural practices.

TSI – see timber stand improvement

TTRA - see Tongass Timber Reform Act

Tube -

turbidity - An indicator of the amount of sediment suspended in water.

two-aged stands – Stands that contain two age classes of trees.

type conversion - The conversion of the dominant vegetation in an area from forested to non-forested or from one species to another.

underburn - A burn by a surface fire that can consume ground vegetation and "ladder" fuels.

understory - The trees and woody shrubs growing beneath the overstory in a stand of trees.

uneven-aged management - Actions that maintain a forest or stand of trees composed of intermingling trees that differ markedly in age. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

unregulated harvest - Tree harvest that is not part of the allowable sale quantity (ASQ). It can include the removal of cull or dead material or non-commercial species. It also includes volume removed from non-suitable areas for research, to meet objectives other than timber production (such as wildlife habitat improvement), or to improve administrative sites (such as campgrounds.)

unsuitable lands - Forest land that is not managed for timber production. Reasons may be matters of policy, ecology, technology, silviculture, or economics

utility logs - Those logs that do not meet sawlog grade but are suitable for production of firm, usable pulp chips.

value comparison unit (VCU) – Distinct geographic area whose boundaries generally follow natural water divides.

variety class - A way to classify landscapes according to their visual features. This system is based on the premise that landscapes with the greatest variety or diversity have the greatest potential for scenic value.

vegetation management - Activities designed primarily to promote the health of forest vegetation for multiple-use purposes.

vegetation type - A plant community with distinguishable characteristics.

vertical diversity - The diversity in a stand that results from the different layers or tiers of vegetation.

viable population - The number of individuals of a species sufficient to ensure the long-term existence of the species in natural, self-sustaining populations that are adequately distributed throughout their range.

viewshed - An expansive landscape or panoramic vista seen from a road, marine waterway, or specific viewpoint.

virgin forest - A natural forest virtually uninfluenced by human activity.

visual quality - The level of visual quality or condition presently occurring on the ground. The six visual condition categories are the following:

- *Type I: Natural condition. Areas where only ecological change has taken place. Corresponds to the Preservation visual quality objective (VQO).*
- *Type II: Natural appearing. Areas where changes in the landscape are not noticed by the average forest visitor unless pointed out. Corresponds to the Retention VQO.*
- *Type III: Slightly altered. Areas where changes in the landscape are noticed, but do not attract attention. Corresponds to the Partial Retention VQO.*

- *Type IV: Moderately altered. Areas where changes in the landscape are easily noticed and may attract attention. Corresponds to the Modification VQO.*
- *Type V: Heavily altered. Areas where changes in the landscape obviously appear to be major disturbances and stand out as a dominating impression of the landscape. Corresponds to the Maximum Modification VQO.*

visual quality objective (VQO) - A set of measurable goals for the management of forest visual resources.

visual resource - A part of the landscape important for its scenic quality. It may include a composite of terrain, geologic features, or vegetation.

water table - The upper surface of groundwater. Below it, the soil is saturated with water.

water yield - The runoff from a watershed, including groundwater outflow.

watershed - The entire region drained by a waterway (or into a lake or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.

wetlands - Areas that are permanently wet or are intermittently covered with water.

wilderness - Federal land designated by Congress and retaining its primeval character, without permanent human habitation or improvements. It is protected and managed to preserve its natural condition.

wildfire - Any wildland fire that is not a prescribed fire.

wildlife analysis area (WAA) - A division of land used by the Alaska Department of Fish and Game for wildlife analysis.

wildlife habitat diversity - The distribution and abundance of different plant and animal communities and species within a specific area.

windthrow - Trees uprooted by wind.

wood fiber production - The growing, tending, harvesting, and regeneration of harvestable trees.

woodland products - Harvestable items from pinion-juniper woodlands. These include fuelwood, posts, pine nuts, and Christmas trees.

yarding - Moving the cut trees from where they fell to a centralized place (landing) for hauling away from the stand.

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———. 2002h. Subsistence Resource Report for the Tuxekan Island Timber Sale. Prepared for the USDA Forest Service, Thorne Bay Ranger District, Thorne Bay, Alaska. Seattle, Washington.

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Distribution List

Agencies, organizations, and persons receiving the Final Environmental Impact Statement

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Advisory Council on Historic Preservation, Director, Planning and Review

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Alaska Department of Environmental Conservation, Kevin Hanley, Environmental Specialist

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Sport Fishing Division, Steve Hoffman
Division of Habitat & Restoration,
Bill Hanson, Moira Ingle
Division of Subsistence, Mike Turek
Division of Wildlife Conservation, Kim Titus

Alaska Department of Natural Resources, Mark Minillo
Division of Forestry, John Crowley
Office of Program Management and Permitting, Joe Donohue and Ben white

Alaska Department of Transportation, Director

Alaska Office of the Governor, Alaska Land Use Council
Division of Governmental Coordination,
Central Office, Jennifer Garland, Project Review Coordinator

Interstate Commerce Commission, Chief, Energy and Environment

National Oceanographic and Atmospheric Administration (NOAA),
Office of Policy and Strategic Planning

Rural Utilities Service

U.S. Department of Agriculture (USDA) Forest Service

USDA Forest Service, Alaska Regional Office
Director
Regional Forester
Print Spec.

USDA Forest Service, Chugach N.F., Forest Supervisor

USDA Forest Service, Rocky Mountain Research Station

USDA Forest Service, Tongass N.F., Forest Supervisor
- Admiralty National Monument, District Ranger
- Craig Ranger District, District Ranger
- Doc. Prod. Coordinator., Sue Jennings
- Environmental Coordinator, Dennis Rogers
- Environmental Coordinator, Larry Lunde
- Forest and Fire Mgt.
- Hoonah Ranger District, District Ranger
- Juneau Ranger District, District Ranger
- Ketchikan-Misty Ranger District, District Ranger
- Petersburg Ranger District, District Ranger
- Sitka Ranger District, District Ranger
- Thorne Bay Ranger District, District Ranger
- Wrangell Ranger District, District Ranger
- Yakutat Ranger District, District Ranger

USDA Forest Service, Washington Office, Director, Ecosystem Mgmt. Coordinator.

USDA National Agricultural Library, Head, Acquisitions, and Serials Branch

USDA National Resources Conservation Services, National Environmental Coordinator

USDA Office of Civil Rights

USDA APHIS PPD/EAD, Deputy Director

National Marine Fisheries Service, Protected Resources Mgmt. Div., Reg. Administrator

U.S. Department of Defense
- U.S. Army Corps of Engineers,
- Alaska District, Regulatory Branch, East Section, Glen Justis,
- Chief Field Office Manager-Juneau Engineer Division, Pacific Ocean

U.S. Department of Energy, Director, Office of Environmental Compliance

U.S. Department of the Interior, Office of Environmental Policy and Compliance
- Bureau of Land Management, Alaska State Office
- Alaska Area Region Office of Environmental Policy and Compliance, Pamela Bergmann
- Fish and Wildlife Service Juneau Office, Richard Enriquez
- Ketchikan Office

U.S. Department of Transportation,
- Federal Aviation Administration, Office of the Regional Administrator
- Federal Highway Administration, Regional Administrator
- Federal Railroad Administration, Office of Transportation and Regulatory Affairs Research and Special Program Admin.

U.S. Coast Guard, Environmental Impact Branch, Marine Environment and Protection Division

U.S. Environmental Protection Agency,
- Chris Meade
- EIS Review Coordinator
- Office of Federal Activities, EIS Filing Section

Media

Juneau Empire

Ketchikan Daily News, Ketchikan Office

KFSK News

Organizations and Businesses

Aboriginal Rights Committee, Tom Lang, Chairman

Alaska Forest Association, Owen J. Graham

Alaska Forest Products, Hal Rhodes

Cascadia Wildlands Project, Gabriel Scott, Alaska Field Rep.

The Center for Biological Diversity,
Susie Roe

Earthjustice, Tom Waldo

Edna Bay Fish & Game Advisory Committee, David Gaither, Chair

Forest Conservation Council,
Western Regional Office

Gateway Forest Products, Kent Nicholson

Glacier Grotto, Dave Love

Greenpeace, Larry Edwards

Meridian Environmental, Jeff Boyce

Natural Resource Defense Council,
Nathaniel Lawrence

Port Baker Community Council,
Donald Hernandez

Port Protection Community Association

Sierra Club, Mark Rorick

Sitka Conservation Society, Corrie Bosman

Southeast Alaska Conservation Council, Susan Schrader, Dave Sherman

Tongass Cave Project, Pete Smith

University of Alaska, Land Management, Steve Connelly

University of Minnesota, Forestry Library, Cheryl Owens

Public and Tribal Officials

Alaska State Representative, Albert Kookesh

Angoon Community Association, President

Cape Fox Corporation, Bruce Borup, CEO

The Central Council of Tlingit and Haida Indian Tribes of Alaska (CCTHITA),
Edward K. Thomas, President

Chilkat Indian Village (Klukwan), President

Chilkoot Indian Association

City of Coffman Cove, Mayor

City of Craig, Mayor

City of Hydaburg, Mayor

City of Kasaan, Mayor

City of Ketchikan, Mayor

City of Klawock, Mayor

City of Thorne Bay, Mayor

Community Council of Hollis

Community of Naukati West

Community of Whale Pass

Craig Community Association, President

Douglas Indian Association, President

Haida Corp., President, Alvin Edenshaw

Hoonah Indian Association, President

Hydaburg Cooperative Association, President

Kavilco, CEO, Louis Thompson

Ketchikan Gateway Borough, Mayor

Ketchikan Indian Community, President

Klawock Cooperative Association, President

Klawock Heenya Corporation, Business Manager, Patricia Rowan

Metlakatla Indian Community, Mayor

Organized Village of Kake, President

Organized Village of Kasaan, President

Organized Village of Saxman, President

Petersburg Indian Association, President

Sealaska Corporation, Chairman, Albert Kookesh

Shaan Seet Inc., General Manager, Todd Tew

Sitka Tribe of Alaska, Chairperson

Tongass Tribe, President

United States Representative, Don Young

United States Senator, Lisa Murkowski

United States Senator, Ted Stevens

Wrangell Cooperative Association, President

Yakutat Tlingit Tribe, President

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Pelican Public Library

Petersburg Public Library

Skagway Public Library

Tenakee Springs Public Library

Thorne Bay Community Library

Wrangell Public Library

Individuals

Joanne Daunt

Charley Streuli

List of Preparers

Draft EIS Preparers

- URS Corporation[1]

Final EIS Preparers

• Terry Fifield	Archaeologist – Thorne Bay RD, Tongass NF
• Sharon Frazey	Fisheries Biologist – BLM
• Denise Hann	Fisheries Biologist – TEAMS
• Chad Hermandorfer	Hydrologist - TEAMS
• John Jesenko	Logging Transportation Specialist – TEAMS
• Larry Kent	Silviculturist- TEAMS
• Cass Klee	GIS Specialist- TEAMS
• Julie Laufman	Botanist- TEAMS
• Brian Bair, Betsy Hamman	Wildlife Biologist – TEAMS
• Barb Ott	Sociologist- TEAMS
• Jan Spencer, Lisa Whitcomb	Landscape Architect - TEAMS
• Kristin Whisennand	Writer/Editor – TEAMS
• Paul Valcarce	Landscape Architect – Craig RD, Tongass NF
• Kristin Whisennand	Writer/Editor – TEAMS
• Thomas J. Elliot	GIS – Digital Visions
• Cassandra Klee	GIS - TEAMS
• Sue Wingate, Patty Beyer	IDT Leader - TEAMS

Other Contributors

• Sue Alexander	R10 Regional Economist
• Jim Beard	Fish Biologist, Thorne Bay RD, Tongass NF
• Steve Brockmann	US Fish & Wildlife Service
• Joe Cook, PhD	Associate Professor of Biology and Curator of Animals, Museum o Southwestern Biology, Albuquerque (endemic mammals)
• Glenn Cross	GIS Specialist, Thorne Bay RD, Tongass NF
• Mike Curran	Alaska Department Natural Resources
• Marlin Day	GIS Specialist, Thorne Bay RD, Tongass NF
• Karen Dillman	Ecology Botany Petersburg RD, Tongass NF
• Marla Dillman	Zone Ecologist, Thorne Bay & Craig RD, Tongass NF
• Robert Emley	Engineer, Ketchikan/Misty Fjord RD, Tongass NF
• A. David. Every	URS Corporation, Project Manager, Seattle, WA
• Dale Fife	Engineer, Thorne Bay RD, Tongass NF
• Duane Fisher	GIS Coordinator, SO, Tongass, NF
• John Gier	Hydrologist, Thorne Bay & Craig RD, Tongass NF
• Susan Howell	Fish/WL Staff, Thorne Bay RD, Tongass NF

[1] A complete list of individual preparers is located in the project record.

- Mike Jacobson — US Fish & Wildlife Service, Raptor Biologist (bald eagles)
- Sue Jennings — Document Coordinator, SO, Tongass NF
- Chuck Klee — Planner/Silviculturist, Thorne Bay RD, Tongass NF
- Steve Kozlowski — Sealaska Timber Corp
- Patti Krosse — Ecology/ Botany Ketchikan, Tongass NF
- Dennis Landwehr — Forest Soil Scientist, Tongass NF
- Jan Larum — R10 RO - Forest Management
- Mark Minnillo — Alaska Department Natural Resources, Prince of Wales Area Office, Craig, Alaska
- Shirley Matson — Writer/Editor, Craig RD, Tongass NF
- Cole Mayn — Zone Soil Scientist, Tongass NF
- Mike McClellan — Pacific Northwest Research Staff, USDA FS
- Scott McDonald — Silviculture Shop, Thorne Bay RD, Tongass NF
- Fred Norman — Engineer, Ketchikan/Misty Fjord RD, Tongass NF
- Greg Palmieri — Alaska Department Natural Resources
- Boyd Porter — Alaska Game and Fish Dept.
- KK Prussian — Hydrologist, Thorne Bay RD, Tongass NF
- Kim Redmond — Timber Sale Administrator, Thorne Bay RD, Tongass NF
- Jim Russell — Forest Silviculture Program Manager, Tongass, NF
- Dave Schmid — Former Thorne Bay DR, Tongass NF
- Cynthia Sever — Timber Planning Program Manager, SO, Tongass NF
- Paul Slenkamp — Alaska Department of Natural Resources
- Winston P. Smith — Research wildlife biologist, Forestry Sciences Lab (endemic mammals)
- Linda Shaw — NOAA Fisheries - Endangered Species Act/Essential Fish Habitat
- Mike Sheets — Forester/Silviculturist, Craig RD, Tongass, NF
- Linn Shipley — Wildlife Program Manager , Tongass NF
- Sheila Spores — Silviculturist, Ketchikan/Misty Fjord RD, Tongass, NF; R-10ReAgg Contact
- Billy Steele — Silviculture, Thorne Bay RD, Tongass NF
- Charlie Streuli — Timber Sale Planning Group Leader, SO, Tongass NF
- John Stevens — GIS Specialist, Thorne Bay RD, Tongass NF
- Dennis Sylvia — Zone Planning Staff Officer, Thorne Bay & Craig RD, Tongass NF
- Brian Templin — Craig City Planner
- Julianne E Thompson — Hydrologist, SO, Tongass NF
- Jeff Tilley — Forester, Acting TMA, Thorne Bay RD, Tongass NF
- Pat Tierney — Silviculturist , Thorne Bay RD, Tongass NF
- Ken Vaughan — Deputy Director Engineering & Aviation, RO, Tongass NF
- Susan Wise-Eagle — GIS Coordinator, Wrangell RD, Tongass NF

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